

MICRO

Advancing Computer Knowledge

Operating Systems



OS-9

The Best OS for 6809
Microprocessors



PASCAL

Machine Level Read and
Write



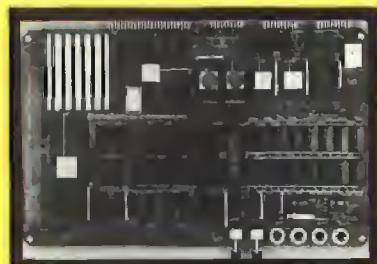
APPLE DOS

Improve Your Apple With
A New OS



Color Disk OS

Restore A Crashed Disk
Recover Your Directory

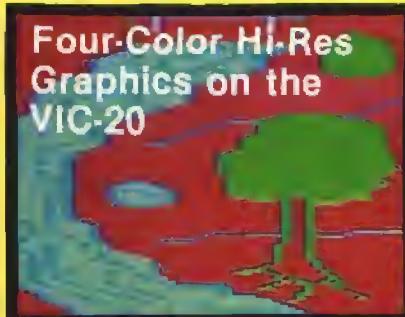


The 68000 Educational Board Reviewed
Redesign Your PET Calculator Keyboard
Atari Program Perfects Calibration

In this month's Learning Center:



**Music, Music,
Music — with VIC
Player**



**Four-Color Hi-Res
Graphics on the
VIC-20**



**A Lightpen for the
Atari, VIC-20 and
C64**

**BUY A BANANA.
SAVE A BUNCH.
MORE TO COME.**



Leading Edge Products, Inc., 225 Turnpike Street, Canton, Massachusetts 02021.
Call: toll-free 1-800-343-6833; or in Massachusetts call collect (617) 828-8150. Telex 951-624.

DISCSAVERS

VINYL PROTECTIVE DISK SLEEVES



COLOR CODED: Multi-color DiscSavers™ are designed for easy recognition of individual disks with your own color-keyed filing system. Ideal for office or home use.

PROTECTIVE: Custom grain vinyl provides added protection for magnetic disks by guarding against common handling hazards.

ATTRACTIVE: DiscSavers provide a handsome and professional method of single disk storage and enhance the look of your hardware while protecting your valuable software.

Circle No 1

DURABLE: Rigid vinyl construction protects against constant handling to ensure long wear and tear.

PORTABLE: DiscSavers are the only portable vinyl disk sleeves for use with a single diskette that bear the RockRoy mark of quality.

Contact your Dealer or Distributor.



Computer Products Division

7721 E. Gray Road
Scottsdale, Arizona 85260
(602) 998-1577
Toll-Free 800-528-2361

...and so there were keys for the Atari 400.



In the beginning there was the membrane keyboard.

So it was to be done that Inhome Software would create a full-stroke keyboard for the Atari 400 Home Computer and it would be called the B Key 400, and would sell for ~~\$119.95~~ U.S. funds. (Now just ~~\$44.95~~)

The new B Key 400 was made so easy to install that the owner could do it himself in a miraculous two minutes.

With the B Key 400 keyboard from Inhome Software, you will follow into the land of professional home computers that are powerful, easy to program and have a great capacity that can be made even greater with Inhome Software 48K and 32K memory boards. It was done and it was good.

INHOME  **SOFTWARE**

Inhome Software Incorporated, 2485 Dunwin Drive, Mississauga, Ontario L5L 1T1. (416) 828-0775. Made in Canada.

ATARI is a registered trademark of ATARI USA
No. 61 - June 1983

MICRO

Circle No. 2

Highlights

Your computer system is only as good as your operating system. New operating systems coming on the market provide the consumer with products that are more powerful and easier to use than most earlier versions. The June issue of MICRO takes a look at some of these operating systems including OS-9 and Motorola's MEX68KECB educational computer board. Our feature section will help you learn about many of these exciting new items and enable you to choose the right options for your particular needs and computer system.

We open our feature section with an article by Phil Daley entitled "Apple Operating Systems" [pg. 20]. Phil discusses operating systems that can be used with both unmodified Apples and with those requiring additional hardware. All the systems use standard DOS 3.3 format disks. Steven Lesh, in "U.C.S.D. Directory" [pg. 26] examines the U.C.S.D. directory at the byte and bit level rather than in the usual terms of high-level language data structures. Included is a brute-force method of accessing U.C.S.D. directory blocks.

"OS-9, A Structured Operating System" by Mark Boyd [pg. 32] is a summary of OS-9, one of the most powerful systems for an 8-bit microprocessor. MICRO follows up on Mark's article with "A Unix-Like Operating System for the 6809 Microcomputer, Part 1" by Steve Childress [pg. 46]. Steve discusses the "power-per-dollar" of hardware as yet untapped due to manufacturers' fears of software incompatibility. Steve claims OS-9 is a new way to view software architecture that is beneficial to the small-computer user.

William Clements reviews the Color Computer disk system, examines disk sectors, and explains how to repair a crashed directory in "Comments/Utilities on Color Disk BASIC" [pg. 34]. And finally, to complete our feature section see Terry Jackson's "A Review of the 68000 Educa-

tional Board" [pg. 42], an overview of Motorola's new 68000 educational computer board.

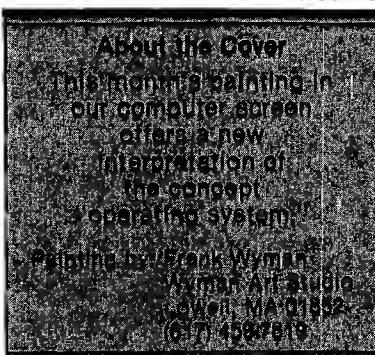
In our applications section we have three articles designed to assist you in problem solving. First, if you are building remote sensors for a personal computer you may encounter trouble calibrating the homebrew sensors. See Mike Dougherty's program "Calibrating by Least Squares Polynomials" [pg. 54], which allows a set of calibration data points to be fitted with a least squares polynomial. "Pinewood Derby with Computer Timing" by Sidney

Koegler [pg. 60] eliminates the arguments and frustrations of judging the Boy Scouts' Pinewood Derby! Here is an automated timing and judging program that uses photo-sensors installed at the finish line. For those of you who feel helpless when converting BASIC decimal results to fractions, Dr. LeRoy Moyer has written a program that automates such calculations in "Fractionated BASIC" [pg. 64].

This month the Learning Center provides you with three programs that educate and entertain. Brian Zupke teaches you

how to use the VIC's joystick to draw high-resolution pictures in four different colors. Study "Four-Color Hi-Res Graphics" [pg. 70]. Do you dream of becoming a *note-able* musician? Phil Daley's "VIC Player" [pg. 72] is a five-octave keyboard on which you can compose your own tunes or play old favorites while learning music programming. And David Bryson shows you how to construct a lightpen for approximately \$15.00 and two hours of work. Read "An Inexpensive Lightpen for the VIC-20, C64, and Atari" [pg. 82].

Our machine-language utilities include the continuation of Joe Hootman's series on "68000 Instructions" [pg. 88] and Randy Hyde's "Parameter Passing, Part 2" [pg. 94]. Also included is Bob Sullivan's "HEXPAD: Utility for M/L Key-ins" [pg. 90].



IS THERE LIFE AFTER BASIC ? YES ! WITH... COLORFORTH™

MOVE UP FROM BASIC! Forth is a new, high level language available now for the TRS-80® Color Computer. COLORFORTH, a version of fig FORTH, has an execution time as much as 10 to 20 times faster than Basic, and can be programmed faster than Basic. COLORFORTH is highly modular which make testing and debugging much simpler. COLORFORTH has been specially customized for the color computer and requires only 16K. It does not require Extended Basic. When you purchase COLORFORTH, you receive both cassette and RS/DISK versions, the standard fig EDITOR and an extensive instruction manual. Both versions and 75 page manual \$49.95

Add \$2.00 shipping

Texas residents add 5 percent

Circle No. 3

DEALER AND AUTHOR INQUIRIES INVITED

ARMADILLO INT'L SOFTWARE
P. O. Box 7661
Austin, Texas 78712



Phone (512) 459-7325

NEW LOWER PRICES

dBASE II	ASHTON TATE	\$489.00
BOTTOM LINE STRATEGIST	C.ITOH	279.00
PROWRITER PARALLEL		399.00
F-10 55		1799.00
F-10 PARRALLEL/SERIAL		1359.00
GRAPPLER INTERFACE		125.00
PROWRITER II		789.00
CALIFORNIA COMPUTER SYSTEMS		
ASYNCHRONOUS INTERFACE		\$129.00
SYNCHRONOUS INTERFACE		149.00
CALENDAR CLOCK		105.00
RS232 INTERFACE		124.00
PROGRAMMABLE TIMER FOR APPLE		99.00
COMSHARE TARGET MARKETING		
PLANNER CALC.		\$79.00
TARGET FINANCIAL MODELING		249.00
CONTINENTAL SOFTWARE		
HOME ACCOUNTANT FOR APPLE		\$59.00
HOME ACCOUNTANT FOR IBM		109.00
DICTRONICS, INC.		
RANDOM HOUSE ELECT. THESAURUS		\$129.00
PROOF READER		50.00
EAGLE		
MONEY DECISIONS		\$99.00
MATH *	FORCE II	\$89.00
dUTIL	FOX & GELLER	\$68.00
QUICKCODE FOR dBASE II		219.00
QUICKSCREEN		129.00

**CALL TOLL-FREE
1-800-523-9511
IN PENNSYLVANIA
1-215-868-8219**

T/MAKER COMPANY		
T/MAKER III		\$199.00
ENHANCER II	VIDEX	129.00
VIDEX KEYBOARD ENHANCER		129.00
VIDEX VIDEOTERM FOR APPLE II	VISICORP	269.00
DESKTOP PLAN APPLE II		\$179.00
DESKTOP PLAN IBM		228.00
VISICALC		179.00
VISICALC ADVANCED VERSION	CALL	
VISICALC BUSINESS FORECASTING		89.00
VISIFILE APPLE II/IBM		CALL
VISILINK		184.00
VISIPILOT FOR APPLE		159.00
VISITREND/VISIPILOT		228.00

IBM IS A TRADEMARK OF INTERNATIONAL BUSINESS MACHINE, APPLE IS A REGISTERED TRADEMARK OF APPLE COMPUTERS, INC., CROSSTALK IS A TRADEMARK OF MICROSTUFF. INFOSTAR IS A TRADEMARK OF MICROPRO. PRICES, SPECIFICATIONS AND AVAILABILITY SUBJECT TO CHANGE WITHOUT NOTICE. NOT ALL PROGRAMS AVAILABLE IN ALL FORMATS. PLEASE CALL FOR ADDITIONAL PRODUCT INFORMATION.

MICROHOUSE
P.O. Box 499/1444 Linden Street
Department 302
Bethlehem, PA 18016
Dealers Inquiries welcome!

INTEGRAL DATA SYSTEMS		
IDS MICROPRISM 480 PRINTER		\$589.00
IDS PRISM-132 PRINTER		1279.00
IDS PRISM-80 PRINTER		999.00
INTERACTIVE STRUCTURES		
PKASSO		\$135.00
INNOVATIVE SOFTWARE, INC.		
TIM III		\$359.00
GRAPHMAGIC		69.00
MATHEMAGIC		69.00
INFORMATION UNLIMITED SYSTEMS		
EASYFILER		\$349.00
EASYSPELLER		159.00
EASYWRITER II		279.00
MAXELL		
FD-1 or FH-1-32 (8" SINGLE SIDED)		\$39.00
FD-2 (8" DOUBLE SIDED)		49.00
MD-1 or MH-1 (5 1/4" SINGLE SIDED)		31.00
MD-2 or MH-2 (5 1/4" DOUBLE SIDED)		48.00
MICROPRO		
CALCSTAR		\$99.00
DATASTAR		165.00
MAILMERGE		149.00
WORDSTAR		279.00
WORDSTAR/MAILMERGE		349.00
MICROSOFT		
128K RAM FOR IBM PC		\$389.00
BASIC COMPILER FOR APPLE II		289.00
128K RAMCARD		389.00
192K RAMCARD		519.00
256K RAMCARD		659.00
64K RAMCARD		259.00
MICROSOFT Z80 PREMIUM PACK		489.00
MICROSOFT Z80 SOFTCARD		249.00
MULTIPLAN		199.00
TASC APPLESOFT COMPILER		129.00
NORTH AMERICAN BUSINESS SYSTEMS		
THE ANSWER		\$229.00
PEACHTREE		
ACCOUNTS PAYABLE		CALL
ACCOUNTS RECEIVABLE		CALL
GENERAL LEDGER		CALL
INVENTORY		CALL
PAYROLL		CALL
SALES INVOICING		CALL
PERFECT SOFTWARE		
PERFECT CALC		\$139.00
PERFECT FILER		199.00
PERFECT SPELLER		139.00
PERFECT WRITER		199.00
QUADRAM		
128K MEMORY EXPANSION		\$380.00
192K MEMORY EXPANSION		475.00
64K MEMORY EXPANSION		280.00
64K MEMOY UPGRADE		129.00
MICROFAZERS ALL MODELS		CALL
QUADBOARD 64K		459.00
QUADBOARD 128K		599.00
QUADBOARD 192K		699.00
QUADBOARD 256K		779.00
CONTROLLER FOR ELITE I		
RANA ELITE I		\$99.00
RANA ELITE II		299.00
RANA ELITE III		465.00
RANA ELITE III		599.00
SMITH-CORONA		
SMITH-CORONA TP-1		\$599.00
SORCIM		
SUPERCALC BY SORCIM		\$219.00
SPELLGUARD		189.00

MICROHOUSE™

YOUR MICRO-COMPUTER PEOPLE

MICRO
P.O. Box 6502
Amherst, NH 03031
(603) 889-4330

Managing Editor
Marjorie Morse
Technical Editors
Phil Daley
Loren Wright
Assistant Editor
Emmalyn H. Bentley
Office Mgr./Editorial Assistant
Maureen Dube
Programming
John Hedderman
Contributing Editors
Cornelis Bongers
Dave Malmberg
John Steiner
Jim Strasma
Paul Swanson
Richard Vile
Art Director/Production
Helen Bergeron
Typesetter
Lynda Fedas
Advertising
Sales Manager—Bob Mackintosh
Admin. Assist.—Dawn Blute
Desier Sales
Sales Manager—Kathie Maloof
Linda Hensdill
Circulation
Carol A. Stark
Cindy Schaik
Accounting
Donna M. Tripp
President/Editor-in-Chief
Robert M. Tripp
Publisher
John G. Grow
Associate Publisher/Circulation Manager
Nancy Lapointe

MICRO is published monthly by: MICRO, Amherst, NH 03031. Second Class postage paid at Amherst, NH 03031 and additional mailing offices. USPS Publication Number 483470. ISSN: 0271-9002. Send subscriptions, change of address, USPS Form 3579 requests for back issues and all other fulfillment questions to MICRO, 10 Northern Blvd., P.O. Box 6502, Amherst, NH 03031, or call (603) 889-4330; Telex: 955329 TLX 800-227-1617. *Subscription rates (per year): U.S. \$24.00, \$42.00 / 2 yr. Foreign surface mail \$27.00. Air mail: Europe \$42.00; Mexico, Central America, Middle East, North Africa, Central Africa \$48.00; South America, South Africa, Far East, Australasia, New Zealand \$72.00.* Copyright © 1983 by MICRO. All Rights Reserved.



Operating Systems

20 APPLE II Operating Systems

Phil Daley — A look at the features offered by six popular systems

26 UCSD Directory

Steven Lesh — A description of UCSD at the byte and bit level

32 OS-9, A Structured Operating System

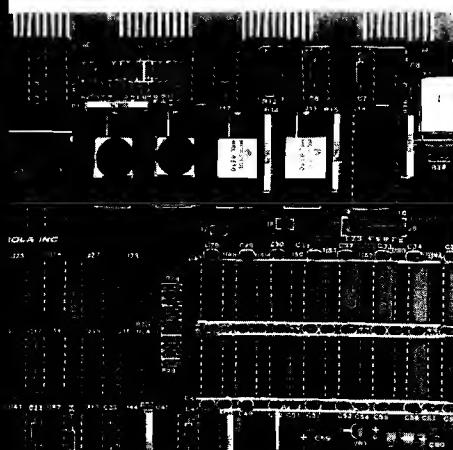
Mark J. Boyd — One of the most powerful systems for 8-bit microprocessors

34 Color Disk BASIC: Observations and Utilities

Michael Dudgeon and William Clements, Jr. — Examine disk sectors and repair a crashed directory

42 The 68000 Educational Computer Board

Terry A. Jackson — Motorola's board features 32K of RAM and a terminal-based ROM monitor



46 A UNIX-like Operating System for 6809 Microprocessors

Stephen L. Childress — A new view of software architecture

BA00	7F	C1	T	F	1	SysGo
BA7F	193	E1	T	F	8	ACIA
BC12	38	F1	T	F	2	TERM
BC4A	631	C1	T	F	1	IOMAN
C29B	BBC	D1	T	F	1	RBF
CES7	41C	D1	T	F	8	SCF
D270	33A	E1	T	F		DC3
DS4D	2C	F1	T	F		D0
DSD9	2F	F1	T	F	1	HO
D603	36	F1	T	F	6	TI
D61E	216	E1	T	F	1	WD1000
D854	CA	C1	T	F	1	CLOCK
D91E	472	11	T	F	2	Shell
DD90	2E	11	T	F		Load
DDBE	48	11	T	F		Unlink
AC00	10A	11	T	F	1	Mdir

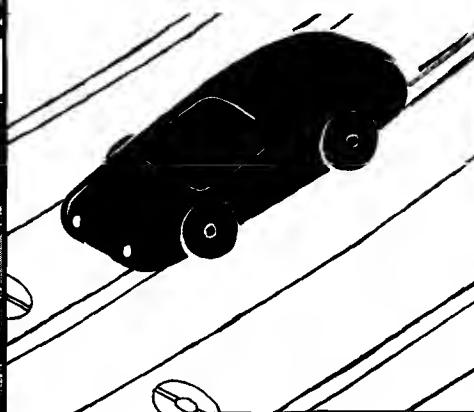
Applications

54 Calibration by Least Squares Polynomials on the Atari

Mike Dougherty — Correct calibration problems in your home-built computer sensors

60 Pinewood Derby with Computer Timing

Sydney S. Koegler — An automated judging and timing program for this popular Cub Scout model car race



Operating Systems Feature

64 Fractionated BASIC

LeRoy Moyer — Automate fraction calculation



The Learning Center

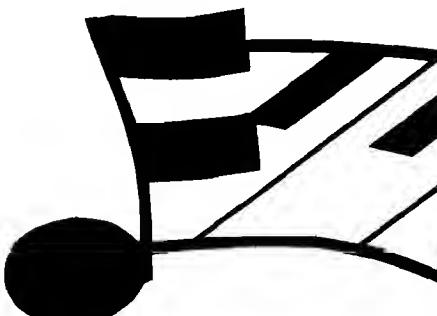
70 Four-Color Hi-Res Graphics for the VIC-20

Brian S. Zupke — Use the joystick to draw four-color pictures



72 VIC Player

Phil Daley and Bob Tripp — Learn music with this five-octave keyboard program



82 An Inexpensive Lightpen for the VIC-20, C 64, and Atari

David A. Bryson — Construct a lightpen for only \$15.00



Machine Language Aids

88 68000 Addressing Modes

Joe Hootman — Immediate, direct, implied, and indirect addressing

90 HEXPAD: PET Utility for Machine-Language Key-Ins

Bob Sullivan — Redesign your PET calculator keyboard

7	8	9	/
4	5	6	×
1	2	3	+
0	.	-	=

94 Parameter Passing in Assembly Language, Part 2

Randall Hyde — Passing parameters via the Return Address

Columns

10 PET Vet

Loren Wright — A review of the Script 64 and WordPro 3 Plus/64 wordprocessors



14 From Here to Atari

Paul Swanson — The InHome keyboard for the Atari 400, Atari 1200XL map modes, and more



18 CoCo Bits

John Steiner — More information on video output

98 Interface Clinic

Ralph Tenny — A discussion on interface components — the latch and shift register

Departments

- 2 June Highlights
- 7 Editorial
- 8 Letters/Updates/Microbes
- 51 Data Sheet
- 106 Software Catalog
- 114 Hardware Catalog
- 118 Reviews in Brief
- 124 6809 Bibliography
- 128 Advertiser's Index

**286K
per 3"
disk
cartridge!**

-- PRESS "RETURN" KEY TO BEGIN COPY --



AFTER YOUR FIRST DRIVE GO WITH AMDISK.

The AMDISK-I Micro-floppy disk system is an engineering breakthrough in disk size storage capacity, media protection and user convenience. It's fully compatible with your Apple II* and Apple IIe and is furnished with an interconnect cable. Enjoy a full 286K storage† capability and the extra convenience of the new 3" hard plastic encased diskette. Packed 10 per box, the disk cartridge fits into a shirt pocket and is easy to mail.

Suggested Retail Price . . . \$299 (3" cartridge \$6.99 ea.)

The Amdisk Single Drive system is ruggedly constructed for years of trouble-free operation and is backed with our 90 day warranty on parts and labor.

Just circle the reader service number for complete specifications.

* Apple II is a registered trademark of Apple Computer, Inc.

† Requires recording on both sides.

2201 Lively Blvd • Elk Grove Village, IL 60007
(312) 364-1180 TLX 25-4786

AMDEK CORP.

Amdek . . . your guide to innovative computing!

MCRC

No. 651-June 1984

My favorite computer dictionary offers this definition of an operating system: 1. An organized collection of techniques and procedures for operating a computer. 2. A part of a software package (program or routine) defined to simplify housekeeping as input/output procedures, sort-merge generators, data-conversion routines, or tests.

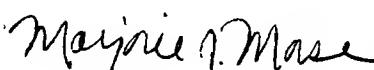
Now you ask, "OK, but what *really* is an operating system?" Unfortunately the definition will not get much clearer. If you are technically oriented and know your computer inside as well as out, you don't need a better definition because you already have a good understanding of operating systems. But, if you're still in a fog, read the articles in our feature section beginning on page 20.

Of course, whatever your level of knowledge, we all know that the operating system is crucial to the running of any computer. The reason we have problems using different software on different computers is that the operating systems aren't compatible. The logical solution seems to be to provide a standard operating system that could run on many different computers. Some steps are being taken in this direction.

As you read through this issue you'll notice that operating systems are usually developed for a particular chip or by a company for its computers. The

6502 world, where there is no standardization, provides the most problems; you'll find Commodore BASIC, Atari BASIC, Atari DOS, Apple DOS, and more. For the most part, 6809-based computers are standardized to FLEX or OS-9, and UNIX is becoming a standard for 68000-based machines.

When you get involved with computers based on the Z80, 8086, etc., you'll find that CP/M is supported by virtually all of these computers. Because all the machines use one operating system, more software is available for these machines than those based on other microprocessors. As a result, many of the manufacturers of the new computers have chosen the Z80 or 8086. And, manufacturers of 6502 microprocessors are beginning to plan for CP/M compatibility on their machines. For instance, Commodore has made provisions for the Z80 or 8086 on their C 128, although neither option is yet available. There will be a Z80 cartridge for the Commodore 64, too. A Z80 card is available for the Apple, as well as a 6809 card, which will allow for CP/M, OS-9, and FLEX.



Marjorie Morse
Managing Editor

MICRO Moves North!

Our new address is: 10 Northern Blvd., Northwood Executive Park
P.O. Box 6502
Amherst, NH 03031

Our new phone number is: (603) 889-4330

Computer
case
Company



• AP103

Attache-style cases for carrying and protecting your complete computer set-up. Accommodates equipment in a fully operational configuration. Never a need to remove equipment from case. Simply remove lid, connect power, and operate.

AP101	Apple II with Single Drive	\$109
AP102	Apple II with Two Disk Drives	119
AP103	Apple II, 9 Inch Monitor & Two Drives	129
AP104	Apple III, Two Drives & Silentype Printer	139
AP105	13" Monitor with Accessories	99
AP106	AMDEK Color Monitor	119
RS201	TRS-80 Model I, Expansion Unit & Drives	109
RS204	TRS-80 Model III	129
AT301	ATARI Computers with Peripherals	109
P402	Centronics 730/737 & Radio Shack Printer	89
P403	Epson MX70/80 or Microline 82A	89
P404	Epson MX100 Printer	99
P405	IDS 560 or Prism 132 Printer	109
P406	Starwriter/Printmaster F-10 Printer	119
P407	Okidata Microline 83A or 84 Printer	99
P408	Prowriter 2 Printer	99
P409	Prowriter (Apple Dot Matrix) Printer	89
IB501	IBM Personal Computer	129
IB502	IBM Monitor	99
HP601	HP41 with Accessories	99
CM703	Commodore Model 64 with Drives	119
CM704	Commodore Model 64 with Dataset	109
NS10	North Star Advantage	139
CC80	Matching Attache Case (5")	85
CC90	Matching Attache Case (3")	75
CC91	Matching Accessory Case	95
CC92	5.25" Diskette Case	49

COMPUTER CASE COMPANY

5650 Indian Mound Court
Columbus, Ohio 43213
(614) 868-9464

CALL TOLL FREE
800-848-7548



Circle No. 6



New FCC Ham Radio Proposal

Dear Editor:

Since the April issue of MICRO featured Communication, I thought you should be aware that the FCC is now proposing a new class of amateur radio license requiring NO morse code test. The class will be intended for people whose primary interest is in computers or experimentation rather than the traditional amateur goals of work-

ing all states or all countries. The license will probably be restricted in power and in frequency, and will be mainly for short-range high-quality communication such as data links.

The existing ham radio community is vigorously opposing this new class and has organized letter-writing programs to the FCC stating their opposition. I would like to suggest that the readers of MICRO would be among those to benefit from such a new class

of license. The FCC should hear from more computer people since the ham radio voice will be well represented opposing the idea.

I believe connecting a radio link to a computer will open a new mode of communication. Comments should be addressed to the FCC referring to docket = 83-28 FCC, Washington DC 20554. Send your comments to MICRO too.

An anonymous radio ham/computerist

Updates and Microbes

Interface Fixes

Four misprints appeared in my article "Building a Parallel Printer Interface" (53:23). In the diagram on page 23, lines A0 and A8 are interchanged. In the same diagram, the STROBE line should not be connected to +5. On page 24 there are two errors in the second column. About halfway down, the text should read "...simply use the Q output from U8 rather than Q." Finally, on the next-to-last line of column 2, the STA command should be changed to LDA.

Rolf B. Johannessen
Rockville, MD

Line Correction

There is an error in my article, "A Binary Search Routine" (57:37). Line 10170 in both listing 1 and listing 2 should be:

10170 For J = J TO 0 STEP -1
instead of
10170 For J = J TO 1 STEP -1

Alfred J. Bruey
Jackson, MI

Send your comments, insights, ideas, or bugs to Letterbox, MICRO, P.O. Box 6502, Amherst, NH 03031.

Parts List

The following parts list was left out of John Steiner's article, "A Home-Built Communications Interface" (59:44).

PARTS LIST MODULATOR

REF. NUMBER	VALUE	NAME
C1	1 UF 16V	CAPACITOR
C2	.03 UF	"
C3	.03 UF	"
D1, D2, D3	IN914 OR EQUIV	DIODE
IC1	LMS566	PLL IC
IC2	LM 339	
Q1, Q2	2N2222	TRANSISTOR
R1	10 K	RESISTOR
R2	1 K	"
R3	1 K	"
R4	10 K	"
R5	10 K	"
R6	1 K	"
R7	10 K	"
R8	5 K	"
R9	2.2 K	"
R10	250	TRIMPOT
R11	1 K	RESISTOR
R12	24 K	"
R13	10 K	"
R14	12 K	"
R15	20 K	"
R16	10 K	"
R17	1 K	"
SW1, SW2	ALL RESISTORS 1/4 WATT SPLIT MINI TOGGLE SWITCH	

PARTS LIST REGULATOR

REF. NUMBER	VALUE	NAME
C1	1 UF	CAPACITOR
C2	1 UF 16V	"
IC1	LM317	ADJ REG IC
R1	220 OHM 1/4 WATT	RESISTOR
R2	5 K	TRIMPOT

MICRO

**SAVE
20%!!!!**
**Subscribe
to
MICRO**
**Use This Postage
Paid Card to Order
the Next 12 Issues
of MICRO and SAVE
\$6.00 Off
Newsstand Price!**

**Feast of
Computing
Ideas...**

**Order These
Books From
MICRO**

**MICRO
Leader
Service...**

**For More
Information
On The
Advertisers
in This Issue!**

MICRO™ **SAVE 20%**

Yes! Enter my subscription to MICRO, and send me the next 12 issues for just **\$24.00**. I save **\$6.00 off** the newsstand price!

Name _____

Address _____

City _____

State _____ Zip _____

I'm paying by Check MO VISA MasterCard

Card # _____ Exp.Date _____

Signature _____



I OWN A:
 Commodore 64 VIC-20
 Apple PET
 Atari 400 Atari 800
 Other: _____

For Faster Service Call:
1-800-345-8112
(In PA: 1-800-662-2444
VISA or MasterCard Only

MICRO™ Books

NEW for VIC-20 Users! Mastering Your VIC-20 With 8 BASIC Projects

A book that makes learning to program your VIC-20 fun! Contains 8 projects and programs. Games, utilities — even a VIC-20 version of "VisiCalc." All 8 programs on cassette to help you learn faster.

Mastering the VIC-20 @ \$23.95

NEW for OSI Users! MICRO on the OSI

Includes Machine-Language enhancements and BASIC Aids, hardware modifications for enhanced/reversed video, programs for control code and upper/lower case entry. A valuable programming tool.

Micro on the OSI @ \$19.95

Best Sellers for APPLE Users! MICRO on the APPLE

Programming aids, utilities, games, enhancements. Together Volumes 1, 2, and 3 contain over 100 programs on diskette. Fully documented and explained.

3-Volume Gift-Boxed @ \$59.95
 Vol. 1 Vol. 2 Vol. 3 \$24.95 ea.

Please rush the MICRO Books I've checked above to:

Name _____

Address _____

City _____ State _____ Zip _____

(Allow 6-8 weeks for delivery)

I'm paying by: Check MO
 VISA MC

Total Enclosed: \$ _____
(Add \$2.00 s/h per book, MA res. add 5% tax)

Visa/MC # _____
 Exp. Date: _____

MICRO™ Reader Service Card

The numbers below correspond to the numbers imprinted on the advertisements in this issue of MICRO. This card valid for 90 days only.

Mail information to:

Name _____

Address _____

City _____ State _____ Zip _____

1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26
27	28	29	30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49	50	51	52
53	54	55	56	57	58	59	60	61	62	63	64	65
66	67	68	69	70	71	72	73	74	75	76	77	78
79	80	81	82	83	84	85	86	87	88	89	90	91
92	93	94	95	96	97	98	99	100	101	102	103	104
											105	106



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 20, AMHERST, NH

POSTAGE WILL BE PAID BY ADDRESSEE

MICRO™

10 Northern Blvd.
P.O. Box 6502
Amherst, NH 03031

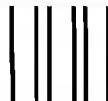


**SAVE
20%!!!!**

**Subscribe
to**

MICRO™

**Use This Postage
Paid Card to Order
the Next 12 Issues
of MICRO and SAVE
\$6.00 Off
Newsstand Price!**



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 20, AMHERST, NH

POSTAGE WILL BE PAID BY ADDRESSEE

MICRO™

10 Northern Blvd.
P.O. Box 6502
Amherst, NH 03031



**A Feast Of
Computing
Ideas...**

**Order These
Books From**

MICRO™



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 20, AMHERST, NH

POSTAGE WILL BE PAID BY ADDRESSEE

MICRO™

10 Northern Blvd.
P.O. Box 6502
Amherst, NH 03031



MICRO™

**Reader
Service...**

**For More
Information
On The
Advertisers
In This Issue!**

SAGE TECHNICAL BRIEFING

SYSTEM DESIGN, SAGE™ IV

The challenge was to create a computer having room for a mega-byte of RAM, a built-in Winchester with floppy backup, and the ability to perform 2,000,000 instructions per second.

A small miracle, in other words.

And small is exactly what it turned out to be. In fact, the 16-bit Sage™ IV, including all of the above attributes, takes up less than 2 cubic foot.

What makes such a breakthrough possible? System design.

It took the latest 64K dynamic RAMs and the Motorola 68000 processor technology, plus Winchester technology. And it took a highly integrated, closely packed, low power, high speed design, incorporating a proprietary bus.

Now the Sage™ IV is ready for you. Actually, you can choose from three different Sage™ IV models to meet your exact needs—configurations with 1.5 megabyte

Meet The New Giant Of The Microcomputer Industry. All 4.8 x 12.5 x 16.75" Of It.

Winchester plus 640K floppy right on up to a combination of four fixed or removable Winchesters plus one or two floppies (1.44 megabytes of disk capacity in all).

Because of the Sage™ IV's non-compromised system design you can load a 16K program in 110 seconds from Winchester disk.

What's more, there are over 120 sources for existing popular programs for the Sage™ IV. The included 8-bit system operating system is standard on every Sage™ IV converts software that was originally written for 8-bit computers in Pascal, BASIC, and Fortran. Optionally, CP/M-68K Modul-3, and Hyper-Forth are also available.

Better yet, our small miracle comes with prices to match.

So give us a call or write today for more Sage™ IV information and the name of your nearest dealer.

Western United States

Sage Computer Technology
35 North Edison Way, #4 Reno,
NV 89502 (702) 787-4368

Eastern United States

Sage Computer Technology
15 New England Executive Park
Suite 120, Burlington, MA 01803
(617) 229-6969

UK

TP LTD., 21 Alma Vale Road
Cillion, Bristol BS8-2JH
Tel: (0117) 742-7116
D: 444-653-4416-2G

In Germany

MM Computer GmbH,
Hahnweg 10, D-8092 Offen-
bergsburg, FRG
Tel: (089) 401-0000
Fax: (089) 401-0000

SAGE
COMPUTER TECHNOLOGY



PROCESSOR

SAGE

PET Vet

Loren Wright

When you start to think about serious applications for your Commodore 64, a word processor should be one of the first to come to mind. Word processors work well with the C64. The extra memory allows more text to be held in memory at one time, and the keyboard allows rapid and accurate entry of text. The 40-column display is not as much of a problem as you would think because of interference of certain colors on some TVs or monitors, being able to change character and screen colors is important.

I have reviewed two very good word processors — *Script 6.1* and *WordPerfect Plus/6.1*. There are others; they will be reviewed as time and space permit.

Script 64

Script 64 is a new word processing program for the Commodore 64 by David Foster of Richvale Telecom-
munications [10610 Bayview Avenue,
Richmond Hill, Ontario L4C 3N3,
Canada]. Richvale's products, in-
cluding Script 64 and the C64 Link car-
tridge reviewed in April, are now
marketed in the U.S. by Computer
Marketing Services [300 W. Marion
Pike, Cherry Hill, NJ 08002]. The disk
version sells for \$139.95.

Design

Unlike other word processors that use either an actual-page or continuous-scroll organization, Script 64 organizes text in 22-line screens. At first this seemed inconvenient, but the more I used the program, the more I could see advantages. Advancing to the next numbered screen is accomplished easily by pressing the 'F1' key. If you advance to the next screen well before you reach the end, then you avoid a lot of problems. This leaves room to insert text later in the editing process. If you keep only a paragraph or two on a screen, then cut-and-paste operations are easy. On printout, incomplete

screens are handled routinely by ignoring the blank lines at the end of a screen. If you do have to fill a screen and continue immediately on the next one, then that can be accomplished

1. *Introduction* 2. *Background* 3. *Methodology* 4. *Results* 5. *Conclusion* 6. *References* 7. *Author's biography* 8. *Notes* 9. *Appendix* 10. *Author's address*

Entry of Text

The normal mode of text entry is called "word stream". That is, everything typed in appears continuously on the screen, with each line the next character appearing at the beginning of the next line, except when in the middle of a word, forming in the end of a paragraph with just the line RETURN key and begin the next paragraph on the next line.

Superscripts, subscripts, the underlined, bold, and italic printings are indicated by special characters within the text. All other formatting conveniences are handled by the computer and on special "structured" screens.

The large control may applies to the whole document and defines such things as the left margin, line length, line spacing, top and bottom borders, page length, page numbering, and placement of a title. Script 64 has a

default control map that is adequate for many applications, but you may change the parameters. You can also save a control map with these altered parameters.

A black and white photograph showing a steep, densely forested hillside. The vegetation is thick, with many trees and shrubs covering the rocky terrain. The perspective is from a lower vantage point looking up the slope.

Editing

and with **Shift** **U** as command key, the cursor moves horizontally to the right. You may also use the arrow keys to move the cursor. The amount of space available depends on the width of the current line. To move the cursor, choose the space width command from the right. The following key sequences also characterize this cursor: **Shift** **U** expands space with characters from the right; **Shift** **U** **U** inserts one by individual character or word. You can enter insert mode where all characters typed are conveniently inserted at the cursor position. Entering and exiting insert mode is more cumbersome than with

It is easy to transfer or copy blocks of text from one position to another, even between widely separated screens. The block is defined using the same procedure as for block deletes.

Whole screens may be deleted or moved, and blank ones may be inserted.

COMPU SENSE

QUICK BROWN FOX	\$60.95
The #1 word processor!	
GENERAL LEDGER	\$19.95
(VIC-20)	
CHECK MINDER	
VIC-20 \$19.95	C-64 \$24.95
HOME INVENTORY	\$19.95
(VIC-20)	
CENTIPOD	\$27.95
Like Centipede, only better!	
FROGEE	\$27.95
The exciting arcade game of Frogger.	
MOTOR MOUSE	\$29.95
What a cheese-e game!	
CRIBBAGE	
VIC-20 \$14.95	C-64 \$17.95
This is the game of Cribbage.	
STAR TREK	
VIC-20 \$12.95	C-64 \$17.95
Excellent adventure game!	
MASTER MIND	
VIC-20 \$12.95	C-64 \$19.95
Makes you think.	
ROACH MOTEL	\$9.95
Kill the bugs!	
YAHTZEE 1.1	\$12.95
YAHTZEE 2.1	\$14.95

TO ORDER:
 P. O. BOX 18765
 WICHITA, KS 67218
 (316) 263-1095
 Personal checks accepted
 (Allow 3 weeks) or
 C.O.D. (Add \$2.00)
 Handling charges \$2.00
 VIC-20® is a registered trademark of Commodore



Circle No. 12

FOXSOFT™

Presents....

Spryte Byter™

For the Commodore 64™

The user affectionate sprite development program. Menu-driven, Mono/Multicolor sprites, joystick/keyboard, Tape/Disk. 20K w/FAST machine language routines. Over 60 commands: ROTATE (any angle 0-360), INVERT/OBVERT, SHIFTS, SYMMETRY, AND/OR, REVERSE, REVIEW, MOVIE (animation). Create and Edit up to 128 sprites per file. For programming efficiency and FUN!

PLUS

The Game Maker

Automatically prepares a base for game development-up to 32 sprites WITHOUT DATA STATEMENTS! Adds SPEED to your games. Saves memory too.

To order: Send check (U.S. Funds) \$29.95 for Cassette, \$34.95 for Disk. Dealer inquiries invited.

FOXSOFT™

P.O. Box 507
 Deer Park, Texas 77536
 (713) 473-6723



A Division of Foxfire Systems, Inc.

Global operations act both on the current file and upon subsequent linked files stored on the disk. There are two separate command codes, plus two more to restart the searches. Replacement is done automatically on all occurrences, without any selective option. The ? character is used as a wildcard to match any character, but there is no ignore-case option.

Printouts

Printouts are done according to the codes contained in the format lines you enter in the text. Before printing, you may specify whether or not to pause between pages, where to generate fill variable blocks, and the number of copies. There is also a global option where you specify the name of the first file in a sequence. Linked files are handled automatically as they are required.

Form Letters and Variable Data

Fill points may be indicated within your text. These will be filled before printout either manually, with data you type in, or automatically, from extra memory or a sequential file. There is no differentiation among fill points in a document, so you must be sure your extra memory or sequential file contains the right items in the proper order.

Frequently used phrases and paragraphs may be defined in extra memory. A few keystrokes, including the appropriate abbreviation, will copy that phrase or paragraph at the current cursor position.

Equipment Compatibility

WordPro is especially designed to operate with the NEC Spinwriter series of printers, so it supports all the features of that line, including special characters on its interchangeable print wheels. Other printers, including Diablo, Quime, TEC, and various Commodore printers are supported too.

This evaluation was conducted using a CBM 4022 printer and a Star Micronics Gemini-10 printer through a

Micro World Electronics (1445 W. Wadsworth Blvd., Chatsworth, CO 80227) interface. Overprinting was not supported on either printer using the standard codes, but it can be done with individual letters (A-Z) for each letter. Side bands, odd subcommands could not be printed using the standard codes, but *WordPro's* alternative characters can be used to produce these and other special effects on the Gemini-10.

Manual

The manual is well organized with an index, table of contents, and reference charts. There is also a series of lessons, and the disk includes a linked letter with examples of most of the format commands.

The one-bound manual is difficult to keep open in a table, but it is punched so you can make it fit into your binder.

Special Features

The success, characters, and border colors in the claimed this is required to accommodate different colors and regularities of some monitors and TVs.

There are tabs, numeric prints, column add/subtract, and hyphenation.

The disk is copy-protected but includes a back-up copy.

WordPro, in its many forms, is the most popular word processor for Commodore equipment. Files are compatible with certain size restrictions between the different versions.

Next Month

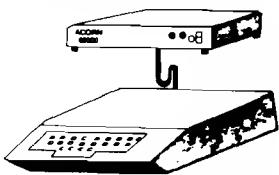
In my July column I'll take a look at FORTH as a development tool for commercial software on the Commodore 64. Also, I'll review some new books for the VIC.

You may contact the author at P.O. Box 6502, Amherst, NH 03031.

MICRO

ACORN 68000

ATTACHED
PROCESSOR
FOR THE
APPLE II™



\$1495

HARDWARE

- 68000 Microcomputer with 16 MHZ clock
- 131,072 Bytes of RAM Memory
- 32,768 Bytes of ROM Memory
- Two RS 232c serial ports up to 9,600 bps
- One million bps interface with APPLE™
- Seven levels of vectored interrupts
- Real time clock and timer
- Separate case and power supply

SOFTWARE

- Uses only one peripheral slot in the APPLE™
- Invisible operation with APPLESOFT or PASCAL
- Compatible with Compilers and 6502 Assemblies
- 68000 Assembly Language Development System

Write or call for a free brochure or send \$10 for 100 page users manual (refunded with order for ACORN)

ACORN SYSTEMS INC.

4455 TORRANCE BLVD., #108 • TORRANCE, CA 90503
Telephone (213) 371-6307

Circle No. 14

*Apple, Apple II and Applesoft are the trademarks of Apple Computer Co



From Here To Atari

Many companies supply products that can be attached to the Atari 400 and almost as many supply products for the Atari 800. Starting with this column, I will include a description of one of these products each month.



InHome B Key Keyboard

I recently installed an InHome keyboard in a customer's Atari 400 computer. This keyboard replaces the membrane keyboard inside the case. The membrane keyboard is smaller than a standard keyboard but the InHome keys are placed at the standard distances from each other. In order to do this and still fit the new keyboard into the same space, a few of the keys at the ends of the rows were relocated to places on each side of the spacebar.

Specifically, there are five relocated keys: CNTL, TAB, CAPS/LOWR, BACK S, and ESC. A period of adjustment is required for touch typists who are very familiar with the layout of the Atari 400 and Atari 800 computer keyboards. The most annoying part of the adjustment is the relocation of the BACK S key. The BREAK key on the InHome keyboard occupies the spot formerly occupied by BACK S. I feel that this point is the keyboard's major weakness; the BREAK and BACK S keys should be reversed.

Once you get past the adjustment period, the keyboard has obvious advantages. All of the keys, including SYSTEM RESET and the three function keys, are full stroke keys on this board. In addition, increasing the distance between the key centers to the standard distance of typewriters makes word processing and other text-oriented tasks even easier. All except one of the keys are labelled almost identically to the keys on the Atari 400 computer keyboard. The only one completely changed is the Atari key, which is now the InHome key.

Adding an InHome keyboard and a 48K memory board to an Atari 400 makes it almost equivalent to an Atari 800 at a savings of up to \$200. You still don't have a right cartridge slot, but that is starting to look like a vestigial organ of Atari 800 computers. Also missing is the circuit for attaching a monitor. For more information write to InHome Software Inc., 2485 Dunwin Dr., Mississauga, Ontario, Canada L5L 1T1.

Commodore 64™ & Apple II™ Assembly Language Debugger



If you are developing software for the Commodore 64 or Apple II or are interested

in assembly language programming, you needed this finely-crafted aid "yesterday." All the features you'd expect in an advanced debugger are included - step, breakpoints, windowing, super-complex conditional breaks, symbolic debugging, patch, show prior 128 steps, and compiled BASIC-like language. Supplied complete with a detailed instruction manual. A new data sheet is available on request.

PTD-6510 Debugger for Commodore 64	\$65.10
PTD-6502 Debugger for Apple II and IIe	\$49.95
Manual (only) for above, each	\$10.00
DisKit 64 Fast single disk copy (+utilities) for Commodore 64	\$75.00

*PTD-6510 (Commodore) requires 1541 disk drive.
PTD-6502 (Apple) requires DOS 3.3, 48K.



PTERODACTYL SOFTWARE™

200 Bolinas Road #27, P.O. Box 538
Fairfax, CA 94930 (415) 485-0714

Circle No. 15

MICRO

by Paul Swanson



On Map Modes

The new Atari 1200XL computer has two new map modes. One of them is mode 15 which is a four-color mode with 160 dots horizontally and 192 vertically. Trying a GRAPHICS 15 statement on an Atari 400 computer or an Atari 800 computer will produce an error 145 because the operating system does not support that mode. It is available on both of those computers, but you must supply your own display list or alter one supplied by the operating system.

Listing 1 alters the display list that results from a GRAPHICS 8 statement. The FOR/NEXT loop in lines 40 through 70 performs this alteration. Line 30 gets the location of the start of the display list first, then the FOR/NEXT loop investigates the list and makes the changes. The specific differences are two types of commands. A decimal 79 (\$4F) loads the memory scan counter for the mode 8 screen. This gets changed to a decimal 78 (\$4E) for a mode 15 screen. Decimal 15 (\$0F) is a mode line command that displays one mode 8 line on the screen. The decimal 14 (\$0E) causes a display of a mode 15 line instead.

The numbering of the commands and the modes can be a little confusing. There are two distinct numbering systems used. The modes declared in GRAPHICS statements are OS (operating system) modes and obey a numbering system quite different from the internal numbering system, referred to as the IR (internal register) mode. OS mode 8 is IR mode \$F and OS mode 15 (Atari 1200XL computers only) is IR mode \$E.



ATARI 1200XL HOME COMPUTER™

The FOR/NEXT loop occupying lines 80 through 150 draws three diagonal bars of color on the screen. The BASIC ? [PRINT] statement to a map mode screen is not documented at all as far as I have been able to determine. It interprets one screen dot per character in the string. If the screen is a two-color screen, as in this example, only the last bit is used in each character. Therefore, if the ATASCII value of the character is an odd number, the

SCIENTIFIC SOFTWARE ASSOCIATES, LTD.



Questionnaire Analysis Software

- Microcomputer based
Avoid the expense of contract services .. do everything in house on your own Apple II+ microcomputer.
- Easy data entry
Avoid time consuming keypunching. Uses respondent-marked cards entered with an Optical Mark Reader (keyboard entry also possible).
- Comprehensive data analysis
Sort on any variable(s), tally all responses, conduct cross tabs, correlations, linear regression, frequency distributions, and more.
- Complete editing capabilities
Weight items, derive composites, add or delete items, and more.
- Easy-to-use
Programs are user friendly, menu driven, and interactive. No special computer expertise is required.

Call or send for more information today.

SCIENTIFIC SOFTWARE ASSOCIATES, LTD.

BOX 208 • WAUSAU, WI. 54401
TELEPHONE: (715) 845-2066

Circle No. 16

Apple II+ is a registered trademark of Apple Computer, Inc.

PET / CBM™

SOFTWARE SELECT !

8032
DISPLAY

OR

4032
DISPLAY

FROM THE KEYBOARD OR PROGRAM
NOW RUN WORD PRO 3 OR WORD PRO 4

FROM THE SAME MACHINE

Available for either 4000 or 8000 Series

ALSO:

For **2001 / 3000** Series Computers

Operate these Models in a Full **8032** Like
Display For Word Pro 4*
and all other 80 Column Software
All installation instructions included.

EXECOM CORP.

1901 Polaris Ave.
Racine, WI 53404
Ph. 414-632-1004

Circle No. 17

PET/CBM a trademark of Commodore Business Machines

*trademark of Professional Software, Inc.

From Here To Atari (continued)

foreground color is used for the dot and the even numbers produce background colored dots. The ?#6 method is used in this example because DRAWTO cannot be restricted to only even numbered or only odd numbered columns.

The requirement for the even or odd numbered columns is due to the operating system "thinking" that it is maintaining a mode 8 screen. Altering the display list causes the screen image to be interpreted in bit pairs. Beginning on an even row, bit pairs of 01 (binary) result in a dot of the color in register 0, 10 to register 1, and 11 to register 2. Note that this follows the same scheme used in the BASIC COLOR statement numbering.

Listing 2 produces the same display on an Atari 1200XL computer as does Listing 1. Since the operating system "knows" that it is a four-color screen, the numbers 1, 2, and 3 are used instead of the pairs 01, 10, and 11. On four-color screens, each character in the string contributes the last two bits of its ATASCII value.

Listing 3 demonstrates the increased resolution between mode 7 and mode 15. This listing (and Listing 1) will work on the Atari 400 computer and the Atari 800 computer as well as on the Atari 1200XL computer. Lines 10 through 70 draw the three colored bars on a mode 7 screen. Lines 80 through 100 wait for the RETURN key. Lines 110 through 140 convert the display list to mode 15. The screen will shrink to one half height because mode 7 has only half the number of lines as a full mode 15 screen.

POKEY Times

I recently received a letter from Ian Chadwick, the Associate Editor of InfoAge and author of *Mapping the Atari*. He suggested that I include some information on the POKEY timers in my column. His observation that the Atari documentation does not adequately cover them has some merit.

There are three of these timers available for use. All of the times use the AUDF values for initialization, which are the same values used for sound channels 0 through 2. STIMR is another location actually used to start the counters. Each timer sets an interrupt when it counts down to zero.

A couple of peculiarities about the timers reveal some interesting insights into how they operate. They are enabled by setting the corresponding bit at location 16 (decimal) to one. Set timer 1 by POKE 16,193. Note that the keyboard, including the BREAK key, no longer functions. Press SYSTEM RESET to restore the keyboard. The reset puts the value 192 (decimal) back in location 16, disabling the interrupt.

POKEing 193 into location 16 enabled timer 1 when the AUDF value was zero. This causes a constant interrupt, leaving no processor time available and masking all other maskable interrupts. SYSTEM RESET is a non-maskable interrupt that can override the timer interrupt.

Now POKE 53760,10, which sets AUDF1 to 10, giving timer 1 some time when it is counting before it generates

the interrupt. POKE 16,193 to enable the timer and hold down the space bar. Notice that the auto-repeat is irregular and slower and that the keyboard click changed its tune. If you POKE a number smaller than 10 into AUDF1, the auto-repeat will be even slower, the limit being a zero in AUDF1, which stops everything.

Although the examples are BASIC, the BASIC language cannot really function with these timers because interrupt routines cannot be written in BASIC. In machine language, an interrupt routine can handle the timer 1 interrupt very effectively. One of the best uses for the timer interrupts is to time two external events like pulses on the controller jack pins. Set AUDF1 to the interval you want to use to time the event first. Alter \$0210 and \$0211, which is the interrupt vector. Store your interrupt routine starting address here. Set up a flag and a counter in memory and set the flag to zero. Last, enable the interrupt.

The interrupt routine is in three sections, controlled by the value in the flag. When it is zero, just poll the first signal. If it is present, set the flag to one, store anything in location \$D209 (this is STIMR — writing to this location initializes all timers to the AUDF value). Then zero your counter, PLA and RTI. Make sure that you pull A before any RTI and always restore X and Y and any other registers you affect or you will probably crash the system. If the flag is one, increment the counter and test the second signal. If it is present, set the flag to 2 before you restore the registers and RTI. If the flag is 2, just restore registers and RTI.

That sequence will time the duration between the two events polled in the units determined by the value in AUDF1. To start the sequence, just store a zero in the flag. Check for the flag equal to 2 for a completed timing sequence. When the flag equals 2, the counter value is valid. Note that the units are N/63921 seconds, where N is the AUDF1 value, so using 64 for AUDF1 produces units reasonably close to milliseconds. Altering AUDCTL can change the frequency used if this is an inconvenient unit — the default 64 KHz can be altered to about 15 KHz or about 1.79 MHz. The exact frequencies are 15.6999 KHz and 1.78979 MHz for these alternates.

Next Month

The 850 interface seems to be an interesting yet misunderstood device. July's column will clear up questions you may have. Next month's hardware product description will be of the new 80-column RGB interface recently announced by Austin Franklin Associates.

MICRO™

Send your letters to: Paul Swanson, 97 Jackson St., Cambridge MA 02140.

SJB DISTRIBUTORS.

THE MOST COMPETITIVE

PRICES ON COMMODORE.



NEW COMMODORE PRODUCTS

CBM 64	Call
CBM 8500	\$ 695
CBM B700	2990
CBM 1520 Plotter	259
CBM 1701 Color Monitor	279
B Series Software	Call

SOFTWARE FOR CBM 64

Word Processing (WordPro 3+)	\$ 69
Word-Pac (tape)	60
The Assistant Series	
Writer's Assistant (easy and flexible)	99
File Assistant (database with merge)	99
Spreadsheet Assistant	99
Pers. Finance Assist (great reports)	45
Busicalc (Spreadsheet)	55
Coco II (build your own games easily)	45
Home Accounting Package	39
General Ledger, A/R, A/P (with check writing)	ea.139
CBM EasyFinance	50
CBM EasyScript	80
CBM EasyFile	80
Data Manager	70
Stock (investment analysis)	80
Pet Emulator (emulates 4.0 basic)	30
Sprite-Magic (use joystick to design sprites)	19
Assembler Package (cassette or disk, compiled, includes editor, loader, disassembler)	39
Spacebelt	20
Retrable	34

INTERFACES & ACCESSORIES

80 Column Expander	\$159
VIC 1600 Modem	95
VIC 1650 (auto answer, auto dial)	150
VIC 1525 Graphic Printer	329
VIC 1530 Datasette Recorder	65
VIC 1541 Disk Drive	329
VIC Switch (connect 8 64's or Vics to printer, dd)	149
IEEE Interface (64)	85
PET-IEEE cable	33
IEEE-IEEE cable (2m)	43
Parallel Interface (Epson, Okidata, IDS, NEC)	80
RS-232 Printer Interface (Okidata, Diablo, etc.)	60
Programmers Reference Guide	18
Verbatim Diskettes (10 per box)	26
Victree (Programmers Utility)	75

VIC PRODUCTS & ACCESSORIES	
8K RAM Memory Expansion Cartridge	\$ 40
16K RAM	70
24K RAM	105

VIC IEEE Interface	75
VIC 3 Slot Expander	27
VIC 6 Slot Expander	70
RS-232 Printer Interface	65
Cassette Interface	27
Home Finance Package (6 tapes)	47
Gorf (64 also)	30
Ormeo Race	30
Arcade Joystick - Heavy duty w/2 firing buttons! Great for the VIC or 64	25

MONITORS - GREAT RESOLUTION (64 OR VIC)

Armed Color I	\$ 299
Armed II or III	call
Panasonic CT160	279
Comrex 6500 - 13" Color	299
Transitor 20 (High Resolution Green Phosphor)	129
Video/Audio Cable	15

PRINTERS - LETTER QUALITY

CBM 8300, 40 cps	\$1450
Diablo 620, 25 cps	949
ComRiter, 17 cps	819
Transitor 130, 16 cps (auto load, wp features!)	769
NEC 7700 series	2350
NEC 3500 series	1600

PRINTERS - DOT MATRIX

CBM 8023, 150 cps/graphics	589
Epson FX Printer, 160 cps	529
Epson MX-80 w/Graffix	349
CBM Graphics for Epson	65
Okidata 82A, 120 cps (serial and parallel)	429
NEC 8023A (parallel)	439
Okidata 92	559
Star Gemini, 10	360
Star Gemini, 15	499

COMMODORE BUSINESS SERIES

SuperPet (5 languages, 2 processors)	\$1409
CBM 8032 Computer, 80 Column	1029
CBM Memory Expansion, 64K	359
CBM 8050, 1 mg. Dual Drive	1259
CBM 8250, 2 mg. Dual Drive	1500
CBM D9060, 5 mg. Hard Disk	2240
CBM D9090, 7.5 mg. Hard Disk	2600
CBM 2031, 170K Single Drive (New)	489
DC Hayes Smart Modem	220

BUSINESS SOFTWARE

WordPro 4+ or 5+	\$ 309
Administrator	489
VisiCalc (expanded)	199
The Manager (database)	199
BPI A/R, G/L, Job Cost, Inventory, Payroll	ea.325

MasterCard, Visa, Money Order, Bank Check

COD (odd \$5) accepted.

Add 3% surcharge for credit cards.

In stock items shipped within 48 hours,
F.O.B. Dallas, Texas

All products shipped with manufacturer's
warranty.

Prices are subject to change without notice.

TO ORDER CALL TOLL FREE

800-527-4893

800-442-1048

(Within Texas)

Business Hours
Mon.- Fri. 8 to 6, Sat. 10-2

Write for free catalog.

GAME OF THE MONTH

AdventureWriter (make your
own adventure game) 39



SJB DISTRIBUTORS INC.

10520 Plana Road, Suite 206

Dallas, Texas 75238

(214) 343-1328 Circle No. 18



by John Steiner

Last month I commented about accessories that connect to the RF output of the CoCo and provide video output for a monitor. I was not precisely correct: the monitor adapter hooks into the input of the modulator. The unit from Computerware requires removal of the 1372 video IC, which is installed in a socket that comes with the kit. They are reinstalled as a package in the 1372 socket. Three wires leave this assembly to provide power and video to the preamplifier circuit board. The board is postage-stamp size and can be attached to the RF modulator case with the double-stick foam tape provided. A single clip is attached to the audio input line of the modulator, and a jumper is provided that must be cut if you are using a color monitor. Two cables exit the assembly, allowing separate audio and video signals to be available.

Needless to say, I had to justify the purchase of this board, so I bought a green screen monitor. The conversion was worth the expense as the crispness and clarity compared to a television are amazing. The RF output is available in addition to the video signal, which is a real advantage for demonstration purposes. There is a disadvantage in that selecting black and white mode kills color at the RF output, while selecting color puts a fine cross-hatch pattern on the monitor, making it difficult to read. Interestingly, high-resolution color graphics are still available in B/W mode even though there is no color-burst signal present.

Recently I had a long chat with Bob Rosen of Spectrum Projects. While talking with Bob about using the Color Computer with a TV, the subject of radio frequency interference (RFI) came up. If you own a CoCo disk system, probably you are already aware of interference caused by the drive cable. Repositioning and coiling the video cable have been my only remedies for the problem, and yet the interference still persisted. In addition, selecting the 64K RAM mode increased the interference to a point where it was extremely annoying. The problem was one of the major reasons I wanted to use a monitor, which isn't affected by RFI.

Bob suggested a solution to the problem: replace the standard audio-type cable Radio Shack provides to connect CoCo to the monitor with a higher-quality 75-ohm video cable with phono plugs installed. The cable can be made easily using RG-59 Coax and two RCA-style phono plugs; or many video specialty stores have them readily available. I have a video dubbing cable I purchased for my video tape recorder that contains video and audio lines. Replacing the Radio Shack cable significantly decreased the interference, though it was not eliminated entirely. My next step will be to coil the cable through a 1-inch toroid coil.

While on the subject of video interference, removing the TV/computer switch, running the cable directly to the coax inputs or through an adapter to the 300-ohm VHF terminals is advantageous. Don't try to ground the cable or shield to the TV set chassis ground, as I have heard some people suggest. Connecting to chassis on many TVs may be unhealthy, not only to your computer equipment, but to yourself. Some TV chassis are tied directly to the AC line terminals, and connecting the TV plug backwards would be an unforgettable experience.

If you do much work with machine-language files, probably you have wished that you could log the start, end, and execute addresses of your files. Ken Christiansen provides a short utility that will provide you with that pertinent information from either a disk or tape machine-language file. To use the routine, first load (or CLOAD) the program in listing 1, then load your machine-language file. Once loaded, type RUN. The screen will clear and provide both decimal and hex values for the file. There are a few limitations: first, HEX\$ is available only on Extended Color BASIC CoCos. Secondly, auto executing programs and programs that must occupy workspace required for listing 1 must be loaded with an offset. For example, CLOADM "filename", 2000 will load the program 2000 bytes higher than it normally resides.

Last month I promised to comment further on FLEX as I get more accustomed to working with it. For those who may not be familiar with

using a DOS, commands may be memory-resident or disk-resident. If you specify a command, the DOS first looks in memory to see if the command routine is stored there; if not, it turns on the drive and searches the disk. This allows the flexibility of writing your own commands, which can be added to the disk. If a command is not on the disk, a "NOT FOUND" response is printed.

Most commands can be given with files or operation data specified after the command. For example, "LIST, <filename>" will list the textfile called filename to the CRT or terminal. "DATE,month,day,year" will install a new date. In all, there are over 50 commands, files, and utilities included in the package. The EXEC command has the ability to execute FLEX commands stored in a text file. For example, initializing a new disk requires at least three separate commands. These commands can be stored in a textfile and implemented by typing "EXEC, filename." Each command in the file will be read and executed. You can use the BUILD command to build a textfile that contains the desired commands. BUILD is not a text editor but allows entry of single lines of text.

FLEX files can be individually protected, unlike R/S DOS, by using the PROT command. Files can be write-, delete-, or catalog-protected. A write-protect automatically delete-protects as well. The catalog-protect prevents the file from being displayed during a CATALOG command.

LISTING 1

```
10 CLS : P = PEEK(487)*256 + PEEK(487)*256 + PEEK(488) : PRINT "START DEC";P; : PRINT "HEX"; HEX$(P) : 'START
20 P = PEEK(126)*256 + PEEK(127) - 1 : PRINT "END DEC";P; : PRINT "HEX";HEX$(P) : 'END
30 P = PEEK(157)*256 + PEEK(158) : PRINT "EXEC DEC";P; : PRINT "HEX";HEX$(P) : 'EXEC
```

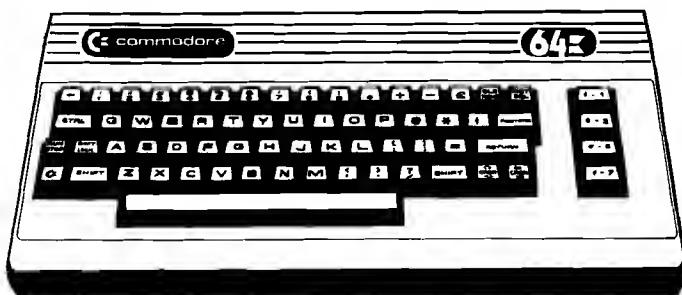
You may contact Mr. Steiner at 508 Fourth Ave. NW, Riverside, ND 58078.

BUSIWRITER

BUSIWRITER A Honey of a Word Processor

Why word processors?

Word processors allow the user to quickly and easily create letters, memos, notes, reports, term papers, manuals, poetry and any other written information using the memory of the computer as a pencil and paper. The computer display or terminal acts as a window through which the user views the information as it is entered. The outstanding advantage of using BUSIWRITER is that it acts not only as a pencil and paper but as a perfect eraser and automatic typewriter.



For Commodore CBM-64

Commodore 1515, 1525, Epson, C. Itoh, Qume, Diablo, NEC Spinwriter, Starwriter, Prowriter, Okidata, Microline, Gemini-10

And many more printers

BUSIWRITER The Queen Bee of Word Processors

BUSIWRITER allows the user to quickly and easily make any number of alterations to the text. BUSIWRITER will instantly reformat your text and show you exactly and continuously how the final output will appear. BUSIWRITER has more functions than any other known microcomputer word processor. With BUSIWRITER assisting in the entry of text, providing a 20 page memory and performing an enormous number of editing/composing functions, the preparation of written data is far faster and outstandingly more accurate than if it were prepared by hand.



BUSIWRITER With the Sting Removed from the Prices

BUSIWRITER 64 only \$99.00 for the CBM 64

BUSIWRITER AVAILABLE NOW FROM YOUR LOCAL DEALER

(800) 227-9998

FOR THE NAME OF YOUR NEAREST DEALER

California, Canada, Alaska and Hawaii please call (415) 965-1735



Skyles Electric Works

231G South Whisman Road
Mountain View, CA 94041

Circle No. 19

Europe please contact Supersoft, Winchester House, Harrow Wealdstone, England HA3 7SJ, Tel. 01 861 1166

APPLE II OPERATING SYSTEMS

by Phil Daley

The operating systems that I have seen available for the Apple use essentially the same read/write routines, but they have been modified or changed. All the disks created by any one system can be read by any other system if you know the procedure. Modifying disks to make them copy-protected (unreadable) is a different technique and a different topic. The Operating Systems covered in this article all use standard DOS 3.3 format disks. The list is as follows: DOS 3.3®, Pascal®, ORCA/M®, Flex®, OS-9® and CP/M®. There are also many varieties and colors of patches and fixes for DOS 3.3 on the market, ranging from Craig Peterson's and the Floeters' articles in *Nibble* to 'DIVERSI DOS' and 'MASTER DOS'.

Except for ORCA, all of the systems have a special {format} command. Whether a user types 'INIT', 'NEWDISK' or 'FORMAT' the results are a disk that is DOS 3.3 compatible as far as the individual sectors are

concerned. The difference is in the boot program installed (or not installed) on the disk, and the directory and other housekeeping type sectors (for instance: the VTOC) written to various tracks on the disk. Having talked to some of the individuals responsible for converting operating systems for other microcomputers to the Apple, I discovered that the lowest common denominator and the reason for this compatibility at the low level is the DISK II Apple disk drive and controller card, which impose certain hardware limitations on the software involved.

DOS 3.3 from Apple Computer Co.

Other than the CONTROL-D kludge, the standard operating system is highly efficient, moderately user friendly, and extremely error free. Other than the misadventures I had with a Corvus Systems hard disk running DOS 3.3, I have crashed a disk only two or three times. Apparently the people at Corvus do their field testing on the first group of unsuspecting customers that come along, with

work the first time because of the lack of a carriage return.

The only file-handling capability that I find missing is a 'LIST' function for textfiles. It would be convenient not to have to run a file reading program to see what is in a particular file.

The technique of a track/sector list of program sectors seems to waste disk space at first glance. (If you want to

talk about waste, consider RS DOS for the Color Computer. The minimum amount of information that can be read or written is a granule — 2,304 bytes of information: one half of a track.) The extra space required for short programs is more than compensated for in quick disk access using random records on large files. DOS is able to calculate the exact track and sector that any particular random-access record resides on, and immediately seek that sector. This is a tremendous improvement over the sector-

linking so prevalent in other systems.

The best consideration for using Apple DOS is that most of the commands are loaded into RAM and stored there while the computer is left on. This means that disk access to a system disk is kept to the absolute minimum and a program rarely requires a specific system program to reside on the program disk (for example, the 'CHAIN' program). In addition, a single drive system is a practical reality. This is not true of the other systems available.

There are also many different patches to the standard DOS on the market today. If one fits a specific

(Continued on page 23)

INTERNATIONAL

SAVE ON ... COMPUTERS • MONITORS PRINTERS • PERIPHERALS • SUPPLIES*



OMEGA BLOCKBUSTER SPECIAL

AMDEK
COLOR I MONITOR
\$289

Manufacturers
Suggested
Retail Price
449.00

Offer Good Thru 5/31/83

NEW!

EPSON FX-80 PRINTER

Now Available
For Immediate Delivery!

- Up To 160 cps • 11 x 9 Matrix • Pinfeed Platen
- Proportional Spacing • Graphics • Elite Pitch
- Centronics Parallel Interface • Internal 2K Ram

It's All New...And It's OMEGA PRICED!
For Our Price...CALL 1-800-343-0873 TODAY!

SAVE ON LETTER QUALITY PRINTERS

DIABLO 620 New Low Price	929.00
DIABLO 630 w/API & cable	1,749.00
NEC 3510 SPINWRITER	1,399.00
NEC 7710 SPINWRITER	2,045.00
NEC 7730 SPINWRITER	2,095.00

BIG SAVINGS ON ACCESSORIES

HAYES SMARTMODEM 300 Baud	230.00
HAYES MICROMODEM II (APPLE II)	289.00
MICROSOFT SOFTCARD PREMIUM SYSTEM	459.00
ORANGE MICRO GRAPPLER +	120.00
PKASO PRINTER CARDS	129.00
RANA ELITE I (APPLE II)	299.00
SIGNALMAN MODEMS (MK I) As Low As ..	85.00

ACCESSORIES & SUPPLIES

OMEGA Has A Complete Line of Accessories & Supplies for the Apple II and many other Popular Computers by manufacturers like:

- D. C. Hayes • Microsoft • Tymac
- M & R Enterprises • Mauntain Computers
- Kensington Microware • Practical Peripherals
- T.G. Products • Videx

SOFTWARE

Omega Carries Software by the following companies:

- American Business Systems • Ashton Tate
- Dakin 5 • Innovative Software • Microsoft
- Sorcim • Stoneware • Visicarp

DOT MATRIX PRINTER BARGAINS

C-ITOH PROWRITER 8510 AP	399.00
IDS MICROPRISM 480	549.00
OKIDATA MICROLINE 92 (NEW)	549.00
OKIDATA MICROLINE 93 (NEW)	859.00
STAR MICRONICS GEMINI 10	349.00

MONITOR SPECIALS FROM OMEGA

AMDEK 300 G	139.00
AMDEK 300 A	165.00
NEC JB1260	119.00
NEC JB1201 M	169.00
USI Pi-2 12" GREEN MONITOR	159.00
USI Pi-3 12" AMBER MONITOR	179.00

MAGNETIC MEDIA

OMEGA Stacks Diskettes by:
• Dysan • Elephant • Maxell • Verbatim

- All Equipment Factory Fresh w/ MFT Warranty
- Prices Do Not Include Shipping Charges
- Mass. Residents Add 5% Sales Tax
- All Returns Subject To Restocking Fee

CUSTOMER PICKUP NOW AVAILABLE

334 R Cambridge St., Burlington, Mass.
(617) 229-6464

CALL TOLL FREE!

1-800-343-0873

Call Toll Free for Ordering.
All Others call (617) 229-6464

CHARGE IT!

MasterCard / Visa

WELCOME AT NO
EXTRA CHARGE

* PRICES, SPECIFICATIONS AND
AVAILABILITY OF ADVERTISED
MERCANDISE SUBJECT TO
CHANGE WITHOUT NOTICE

UNADVERTISED SPECIALS ON • COMREX • EPSON • NEC • IDS PRISM • OKIDATA

OMEGA INTERNATIONAL

334 R CAMBRIDGE STREET, BURLINGTON, MA. 01803

ARK COMPUTING

P.O Box 2025
CORONA, CA 91720

(714) 735-2250

BOOKS	List	ARK
Apple Graphics		
Arcade Book	19.95	15.95
Book of		
Apple Software	19.95	15.95
Elem. Apple	14.95	11.95
Beneath Apple		
DOS	19.95	14.95
Kids & the Apple	19.95	14.95
*Using 6502		
Assem. Lang.	19.95	11.95

UTILITIES	LIST	ARK
Anix	49.95	39.95
Apple Doc	39.95	29.95
Applewriter		
Preboot	19.00	15.00
Bag of Tricks	39.95	29.95
The Dictionary	99.95	69.95
Disk Recovery	30.00	21.95
Transend II	149.00	119.95
Dosource	39.95	24.95
E P F IV	79.95	49.95
Lazer Pascal	39.95	29.95
Graforth	75.00	54.95
ALDS	125.00	89.95
Multi Disk		
Catalog III	24.95	19.95
Sensible Speller	125.00	89.95
Super Disk		
Copy III	30.00	21.95
TASC	175.00	129.95
UCSD P-System		
Software Set	635.00	450.00
Graphics Magician	59.95	49.95
Visicalc Preboot	49.95	39.95
Locksmith	99.95	69.95
Inspector (Disk)	59.95	49.95
Watson (Disk)	49.95	39.95
*Omega Pack	209.85	145.00
(Locksmith, Inspector, Watson)		

WORD PROCESSORS		
	List	ARK
Magic Window	99.95	69.95
Magic Window II	149.95	99.95
Bank Street Writer	69.95	54.95
Pie Writer	149.95	109.95
Easywriter	99.95	69.95
Pro Easywriter	175.00	119.95
Screenwriter II	129.95	79.95
Word Handler	199.00	134.95

ARK'S
APPLE
Software!

SPECIALS

	List	ARK
Axon RAM		
Disk 320	1395.00	1099.00
Wizard		
16K BPO	179.00	119.95
S.A.M.	124.95	84.95
Videx Combo	375.00	235.00

LISA

In celebration of the arrival of the new Apple Lisa Computer to ARK'S office, we are having a **SPECIAL** on the **APPLE II, II+, and //e** programs of the same name...

LISA	49.95	79.95
LISA ED SYS.	74.95	119.95

Disk Drives at BLOWOUT PRICES!!

High quality "Slim-Line" disk drives produced by TEAC	
Single Drive	259.95
Single Drive w/Controller	299.95
2 Drives w/Controller	549.95

DISKETTES

List ARK

Elephant 5 1/4"s/s		
s/d (box of 10)	29.95	19.95
Verbatim 5 1/4"s/s		
d/d (box of 10)	45.00	29.95
Verbatim 5 1/4" d/s		
d/d (box of 10)	65.00	44.95

MONITORS

List ARK

*Comrex 12" Gr.	149.95	89.95
NEC Gr. Screen	285.00	169.95
Amdek Color I	449.95	349.95

Great Games List ARK

*Mandy's new all time favorite...		
Miner 2049er	39.95	29.95
Pinball		
Constr. Set	39.95	29.95
Zaxxon	39.95	29.95
Eggs It	29.95	21.95
Dark Crystal	39.95	29.95
Time Zone	99.95	69.95
Blade of		
Blackpool	39.95	29.95

DISCLAIMER

WE ACCEPT VISA/MASTERCARD, PERSONAL CHECKS (ALLOW 10 DAYS TO CLEAR) OR COD (\$2.00 CHARGE). PLEASE INCLUDE 3% FOR SHIPPING (\$2.00 MIN.) OR 5% FOR BLUE LABEL (\$3.00 MIN.). FOREIGN SHIPPING 10% (\$5.00 MIN.). CALIFORNIA RESIDENTS ADD 6% SALES TAX. ALL ITEMS ARE NEW AND CARRY MANUFACTURERS WARRANTY. PRICES AND AVAILABILITY ARE SUBJECT TO CHANGE WITHOUT NOTICE.

* GREAT DEAL

CALL FOR NEW
FREE CATALOG
(714) 735-2250

(Continued from page 20)

application you can use, then by all means, use it. Generally speaking, none of them do everything well, or even the same as standard DOS, and many of them won't work on anything that is sophisticated - assemblers/editors, word processing, or programs with a write-protection scheme. In other words, about 75% of my disks. If you have a large collection of simple BASIC programs, then one of these may suit you quite well.

PASCAL from Apple Computer Co.

The Pascal operating system requires a 16K RAM card in slot 0. I certainly recommend an 80-column card in slot 3. Having worked in Pascal in 40-column mode, I found it difficult to follow the screen flipping sideways to accommodate the long lines. A nice option is to have a clock card, such as the CPS Multi-function card, included. This will set the system date for you and allow a parallel printer in slot 1 and serial I/O in slot 2.

The text editor is powerful and easy to use, once you get the hang of it. The assembler is a non-standard version, which I avoid using when possible. The compiler is too fussy, and while diagnosing a zillion errors, should correct some of them for you, especially the silly ones, like where all those ';'s belong.

If Pascal were easier to use, I might be tempted to write more programs with it. A straightforward writing of the simplest program starts with

1. Loading the OS from APPLE1:.
2. Calling the text editor.
3. Typing in the appropriate program text.
4. Saving the WORKFILE.
5. Exiting the text editor.
6. Calling the compiler (that's when you discover all those 'syntax errors').
7. Making a list of the mistakes.
8. Calling the text editor.
9. Correcting the errors.
10. Saving the WORKFILE.
11. Quiting the text editor.
12. Compiling the program.
13. Executing the program.
14. Discovering a flaw in the program logic (which sends you back to step 7). That's assuming you corrected all the syntax errors on the first go-round.

Not only is this process inconvenient, but the system drive has to be on-line most of the time, or you get 'diskitis' of the thumb from swapping disks. A two-drive system is minimal but three are better. If you really want to cut the turn-around time between edit/compile, get a hard disk. They were invented with Pascal in mind.

I did not intend to give the impression that I don't like Pascal as a language. I just don't like the Apple implementation. A microcomputer is a one person computer and shouldn't make you wait. If you are familiar with time-sharing systems that make you wait no matter what language you are using, then Pascal is probably a better choice than some of the other languages available on those systems.

ORCA/M from Hayden Software

A new entry into the language development system market, ORCA/M is a self-contained OS and (currently) assembler. In the near future, Hayden intends to add a Pascal compiler into the system. (All the commands are already included.) The Operating System is packed into \$B000-BFFF. Some of the system is also incorporated into the various overlaying parts of the program - text editor, assembler, linker and soon-to-be compiler.

While omitting the BASIC file commands (for obvious reasons), they have included several disk utilities not normally resident in Apple DOS: a PEEK command that invokes a sector editor; a VOLUME command that sets the disk volume number; a TIME command for the current date and time (if you have a clock); an APPEND command that adds a disk file to the current file in memory; a CHECK command that looks for bad sectors, lists a warning if a file is endangered and marks the sector as unusable in the VTOC; a COMPRESS command to either alphabetize the directory or move deleted files to the end of the directory; a COPY command that works like 'FID'; a RESTORE command to restore deleted files; and a SWITCH command to switch directory entries in the catalog.

All commands are memory resident and may be abbreviated to the shortest definable string. The command search is linear, so that a 'C' command would produce the first command with start-

ing with a 'C'. To address a different 'C' command, only enough letters have to be typed to distinguish it from the other 'C' commands.

The text editor produces 'S' (for Source) type files, and the assembler creates 'R' type relocatable object files. The R file must be 'linked' into an address-oriented, BRUNable binary file. During linking, a subroutine library is searched for undefined addresses, allowing the addition of often used routines to the program without having to manually include them in the source file. ORCA/M has a SUB.LIB file with a raft of subroutines for your use. The assembler uses a fairly standard source file format.

Flex for the Apple from Norell Data Systems

Norell has adapted TSC Flex for the Apple computer using their FLEX09 6809 board. Flex is a small, easily adapted OS because it is mainly disk resident. Almost all of the commands reside on disk and are called into use by typing the appropriate command name. This means the system commands are easily modified or appended because each module is an executable binary file. It also means the system disk must be on-line all the time. Two drives are necessary to perform most functions.

The TSC text editor that comes with the system is an elemental line-oriented editor. It would be great with a hard-copy terminal, but most of us work with CRTs. Now, I have some good and some bad news. The good news is that there are several good screen-oriented text editors available for Flex. The bad news is that you would have to get the source file and type it into the Apple, because the disk format is totally different at the hardware level.

Flex has several convenient commands from the system level. The 'P' and 'O' commands, prefaced to any other command, send the output to printer or disk respectively. The 'LIST' command will print any ASCII (BASIC or Text type) file. 'APPEND' will join any number of files (of any type) together into a single file. 'COPY' is like 'FID', including wildcards, but has no prompting. Sometimes you copy programs you didn't intend to by mistake.

A nice feature of Flex is the ease of changing the system commands. At MICRO, we have rewritten several of the commands and added several com-

mands to the original list. Any 6809 machine-language executable file can be a command if its name ends with '.CMD', and it can run at \$C100.

Unfortunately, TSC's extended BASIC is not available as of this date, but Norell Data Systems considers implementation of the Apple version a high priority.

OS-9 from MICROWARE

OS-9 is a newer and more advanced operating system than Flex. Flex is a holdover from the 6800 microprocessor days and was rewritten in 6809 code, but not updated. OS-9 was originally written in 6809 code and utilizes the capabilities of the microprocessor more fully. It includes more advanced technology, such as multi-tasking, and in its higher levels, a multi-user environment.

The OS commands are similar to Flex: they are disk resident and called when needed. However, OS-9 allows loading commands into memory as an option, and removing them when they are no longer needed. Since OS-9 takes up more room in memory than Flex, I still recommend two disk drives.

I don't have access to another system that runs OS-9, so I can't compare it to a standard implementation. The Apple OS-9 disks are DOS 3.3 compatible, and as such must not be compatible with the rest of the OS-9 world.

It is a real pleasure, when working with a word processor, to finish one letter and send it to the printer, while at the same time, working on the next letter on the stack without having to wait for the printer to get done before starting in again [there goes the coffee breaks]. There doesn't seem to be any particular limit to the number of tasks that can be specified to run at the same time, and I gave up after running four tasks simultaneously.

The BASIC that comes with OS-9 is called BASIC09 and is the most Pascal-like language I have seen, without being called Pascal. It includes named procedures with parameter passing, data typing, print using, IF. .THEN. .ELSE. .ENDIF, REPEAT. .UNTIL, WHILE. .DO. .ENDWHILE, LOOP. .ENDLOOP, EXITIF. .THEN. .END EXIT, and variables and line numbers (optional) local to procedures. The text editor checks syntax during line entry, and loop and subroutine nesting upon exit from the editor. It almost makes

BASIC too easy. Compilation is fast and errors return you to the text editor, text file intact. A trace mode aids in debugging. The BASIC file can be PACKed to remove REMs and spaces and reduce the space requirements of the program. BASIC09 computes to 9 decimal digits.

The text editor is line-oriented, common to most BASICs. It uses commands to move from line to line, as line numbers are optional, includes line insert and delete, and has string search and replace. The Debug mode allows controlled program execution, trace on/off, variables examined/changed, procedure-nesting listing and stepping one or more steps through the program.

BASIC09 improves many of the shortcomings of the standard BASIC language by incorporating ideas and structures of the PASCAL language, without adding the faults of PASCAL and losing the interactivity of BASIC.

CP/M from Digital Research

The Appli-Card from Personal Computer Products, Inc., arrived at our office too late to be included in last month's new boards article, so I will briefly mention its attributes now. The board includes a six megahertz Z-80 microprocessor and 64K of RAM. The software includes CP/M 2.2 and drivers for an 80-column card or a 70-column hi-res display, horizontal scrolling of up to 255 characters screen width, and display of all 96 printable ASCII characters. It also has a rewritten FORMAT command that includes formatting, copying the CP/M tracks, and disk copy.

The documentation is clearly written in a step-by-step fashion that should allow someone without extensive computer knowledge to install an Appli-Card and have it running in less than 30 minutes. I also booted up Wordstar, MBASIC, GBASIC, and FORTRAN in less time than it takes to write about it. I waited about eight months to receive this card, and it was worth the wait.

The only problem that I've found is that the CPS Multi-function card software won't recognize the Appli-Card as a CPM card, and the program exits immediately, meaning that I have to use the old Apple Serial card to do my printing. The company is currently working on drivers for specialized cards.

The Control Program for Microcomputers is probably the most popular microcomputer operating system, and if you are looking for a system with a large installed base and corresponding software availability to add to your Apple (no small amount of software already), then CP/M is the system for you. In spite of its problems and slowness, the number of people currently using the system assures its place in the future of microcomputers.

One complaint is that the DIR command does not display the length of the files, although that can be determined with the STAT command. Another complaint is the amount of memory that CP/M requires compared to DOS. A standard 48K Apple without DOS (just for reference, not really too useful — have you used a tape recorder lately?) has 47101 bytes of free memory. Adding DOS to the system reduces the total to 36349 bytes. With MBASIC you have 32883 bytes free without the use of hi-res graphics. GBASIC contains hi-res graphics commands and further reduces the amount of memory free to 23793 bytes. That is on a 64K Z-80 board. If you have a RAM card in slot 0, you can increase the amount of space available for programs to 46076 bytes by moving DOS onto the card.

The Microsoft BASICs available, both M and G, are a more standard implementation (like the big machine versions) than Applesoft, and are easier to learn for someone who knows another BASIC. The file commands eliminate the Control-D, and include reading EOF. The text editor also allows whatever indentation and line spacing that you desire.

Wrapping it all up

Since the Apple is so versatile due to its plug-in slots and OEM support by Apple Computer, many additional operating systems are available that increase the quantity of useable software. The one big disadvantage with all the other systems is the lack of disk compatibility between the Apple Disk II and other microcomputer disk drives. This means that while the programs will execute without many changes, getting the programs into Apple disk format is the biggest hurdle.

MICRO

You may contact Phil at MICRO, P.O. Box 6502, Chelmsford, MA 01824.

TAKE COMMAND OF PLAYER-MISSILE GRAPHICS



PM animator



by Roger Bush

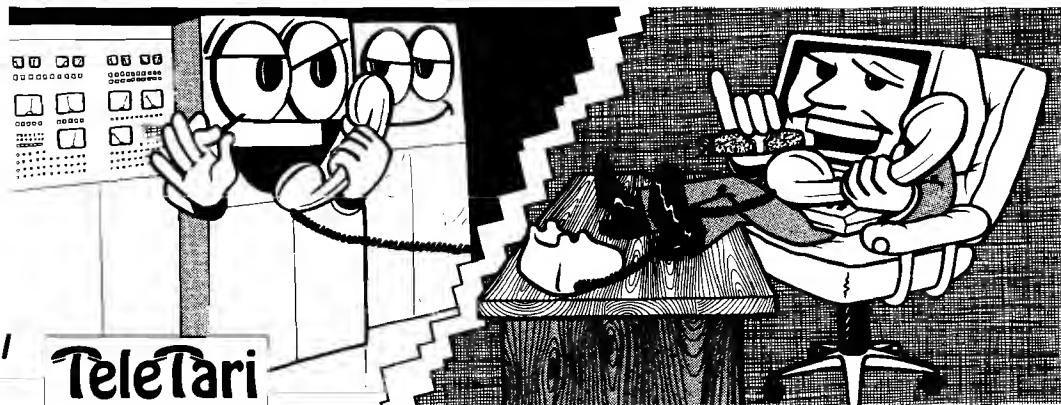
PHONE RIGHT IN WITH **Teletari**

The Friendly Terminal

by Harry Kooms

Want to put your Atari in touch with other computers? **TELETARI** is just what your modem needs: a powerful telecommunications program that's a breeze to use. Choose the functions you want from a menu. Send or receive text or programs, save new data on disk, or print it on paper. A buffer of up to 20K bytes holds your data; page through it to find what you want. Adjust and save terminal parameters with another menu.

TELETARI is adaptable to most remote computers and most modems, including 1200 baud modems. It works through the RS232 port on the Atari 850 Interface, and it's suitable for any RS232 application and supports all 850 options. It's also compatible with the Bit 3 Full-view 80™ board.



Ask your software dealer for **TELETARI**, by **DON'T ASK**. \$39.95. Requires 32K, disk, BASIC, 850 Interface



2265 Westwood Bl., Ste. B-150
Los Angeles, CA 90064
(213) 477-4514

Or order by mail direct from **DON'T ASK**. Add \$2.00 shipping/handling to your check or money order. Calif. residents add 6% sales tax (6.5% if you reside in L.A. County).

Dealer inquiries welcome

Circle No. 22

Atari is a trademark of Atari, Inc. Full-view 80 is a trademark of Bit 3 Computer Corporation

U.C.S.D. PASCAL DIRECTORY

A byte and bit-level demonstration of a brute force method to access U.C.S.D. directory blocks.

by Steven Lesh

The F(iler) program, which comes as part of the Apple Pascal Language System, provides the applications software developer with a number of useful capabilities; e.g., listing titles for files currently in the diskette directory, deleting files from the directory, and changing the date to be associated in a directory entry for each newly written file. Unfortunately, these capabilities are not conveniently available to the applications program user.

In this article, the format of the Apple Pascal diskette directory is examined. In addition to information about specific files, the first directory block contains information relating to the entire diskette. Since the structure of the fields containing this information resembles that of functionally similar fields for a file directory entry, the format for a directory entry is covered first.

The Apple Pascal Language System supposedly conforms to U.C.S.D. Pascal specifications, and so what you read here should apply to other implementations of U.C.S.D. Pascal as well. Hopefully, enough information about directory entry formats will be

provided to allow you to develop most directory-related capabilities your applications software might require. Following the article is a listing for an intrinsic unit that demonstrates how to access file directory entries.

The FILELIST unit source code accompanying this article provides a 'bare bones' directory list capability. It performs a function similar to the U.C.S.D. Pascal Filer L(ist) Directory Command. FILELIST differs from the Filer L(ist) command in that it allows the user to restrict the directory listing to titles for a specific file type even though the file name contains no information about what type of file it is. The procedure INITITLEREAD permits a user to specify a drive number from which the directory is to be read, choose between displaying a file titles list on the monitor or listing it on the printer, and to select the type of file for which directory entries are to be listed (i.e., text, code, or data). If this information is already known, the procedure TITLEREAD can be called directly.

Non-Apple users may have to change the starting and ending directory block addresses (STARTDIR and ENDDIR in FILELIST) to addresses applicable to the U.C.S.D. Pascal implementation for their system.

To illustrate the format of a diskette directory entry, let us examine an entry

for the file 'SYSTEM.WRK.TEXT'. If the Filer E xtended Directory List command is used, the following information would be provided for this file:

SYSTEM.WRK.TEXT 4 27-Sep-82 255
text

The hexadecimal characters stored on disk to represent this entry are:

(file block addresses & file-type
identifier)

nul

FF 00 03 01 03 00

(file name)

S Y S T E M . W R K . T E X T nul
0F 53 59 53 54 45 4D 2E 57 52 4B 2E 54

45 58 54 00

(file creation date)

stx

02 B9 A5

File Block Addresses and File Identification Byte

The first data items in a U.C.S.D. directory entry are the starting and ending block addresses for the file and the file-type byte. The ending block address is actually the address of the first block following the block(s) occupied by the file with which the ending address is associated in the directory.

A directory block address consists of a two-byte hexadecimal value representing the number of the block at which a file begins or ends. On the Apple diskette there is room for 280 file blocks. Since one byte can represent a maximum value of 255 decimal, when a block address of 256 or greater is reached, a '1' is added to the second byte of the value containing the block address and the left byte of the block address "wraps around" starting at x'00' again. For the example file, the block addresses would be translated as follows:

255 (starting address)

FF 00

259 (ending address)

03 01

Following the ending block address for the file is a file-type byte. The three file-type values I have been able to identify are:

x'02' = code file

x'03' = text file

x'05' = data file

FILELIST
requires:
Apple with Pascal

The file identification byte for a code file can be distinguished from the x'02' ('stx') character that sometimes precedes the date (see Locating the File Creation Date below) by the 'nul' character that always immediately follows the file identification byte.

File Title

The next grouping of characters in a directory entry stores the file name. For the example file, the string of hexadecimal characters that represent the file title 'SYSTEM.WRK.TEXT' is:

```
S Y S T E M . W R K . T E X T nul
0F 53 59 53 54 45 4D 2E 57 52 4B 2E 54
45 58 54 00
```

Fifteen bytes are allocated for file title storage regardless of the actual title length. The file title itself is immediately preceded by a one-byte value giving the length, in characters, for the file name (x'0F' in the example). When a title is Remove'd from a disk using the Filer Remove command, this value is changed to a 'nul' character. (Unfortunately, restoring an accidentally removed file seems to require more than reinserting the proper file title length again.)

Locating the File Creation Date

Following the fifteen bytes allocated to file title storage and preceding the date are two bytes whose exact use I was not able to determine. The directory entries for files generated by U.C.S.D. system software — e.g., the E(ditor), C(ompiler), Library etc. — appeared to have a 'nul' character after the file title followed by a 'stx'. (In the hexadecimal breakdowns for the example shown above, I grouped the 'nul' character with the file title.) The byte preceding the date in files generated by applications software using the system procedures REWRITE and CLOSE contained a 'soh' (x'01') character; however, dates for some system 'data' files were preceded by another 'nul' character. By looking for 'nul', 'soh', and 'stx' I was able to find the dates for all files on my Pascal diskettes using FILELIST.

File Creation Date

The file creation date (day, month, and year) is the last item in the direc-

tory entry. An elegant scheme is used to pack all the date information into two bytes (one word). The two bytes containing the date for the above entry are B9 A5. The bit allocations for the date word are as follows:

dddd mmmm yyyy yyd

where: 'd' = day
'm' = month
'y' = year

Five bits are required for a range of values from 1 to 31 to represent the days of the month. In the U.C.S.D. date-word, however, these bits are not contiguous. The leftmost four bits help represent the day of the month, but the next four bits are used to represent the month. Storing a numerical equivalent for a month in the second four bits presents no difficulty; there are 16 possible values and only 12 months. So let's take a look at how the year is stored.

In any given century there are 0 to 99 years. If a value representing one of these years is doubled, it still fits nicely into the last eight bits; in fact, the rightmost bit will always be zero. This is precisely the way the year is stored.

Why? Because the right-most bit of the date word is used to help represent the day. For any day after the sixteenth of the month, a '1' is added to the byte containing the doubled value for the year. Thus, if the value contained in the rightmost eight bits is odd, 16 is added to the value contained in the leftmost four bits to derive a value for days in the last half of the month. The status of the rightmost bit is ignored when determining the value for the year stored in the other seven bits.

Diskette Title, System Date, and Block Address Information

Information about an Apple Pascal diskette is located in the first 26 bytes of block two. The array locations given below assume that you have read block two into a PACKED ARRAY of type CHAR.

The field specifying the first block in which code, text, or data files can be stored begins in block array element three. Armed with this information, you can thief a couple of blocks from the directory if you need them, and if your directory does not need room for 77 files, of course.

Listing 1: FILELIST Program

```
[ $L #6: ]
[ $C © STEVEN LESH 1982 ]
[ $S+ ]
UNIT FILELIST;
INTRINSIC CODE 18 DATA 26;
INTERFACE
CONST
  ALLFILES=0;CODEFILE=2;TEXTFILE=3;DATAFILE=5;
  STARTDIR=2;ENDDIR=5;
VAR
  MONTH,DAY,YEAR: STRING;
  OUTPUTDEV: INTERACTIVE;
  { SUPPLY TWO 'CHARS' CONTAINING THE DATE IN SYSTEM FORMAT }
PROCEDURE READDATE(FIRSTDATECHAR, LASTDATECHAR: CHAR;
  VAR DAY,MONTH,YEAR: STRING);
{ CALL TITLEREAD DIRECTLY IF YOU KNOW: }
{ 1-THE DRIVE # FOR THE DIRECTORY TO BE READ }
{ 2-THE TYPE OF FILE FOR WHICH DIRECTORY
  ENTRIES ARE TO BE PRINTED
  **YOU CAN LIST ALL FILES IN THE **
  **      WITH A FILETYPE OF '0' **
{ 3-THE OUTPUT DEVICE FOR A FILE LIST
PROCEDURE TITLEREAD(DISKUNIT: INTEGER;
  FILETYPE: INTEGER;
  PRINTTITLE: BOOLEAN);
{ INITTITLEREAD ASKS THE USER:
  1-SCREEN OR PRINTER OUTPUT FOR FILE TITLES LIST? }
{ 2-READ THE DIRECTORY FOR WHAT DISK DRIVE? }
{ 3-LIST TITLES FOR WHAT FILE TYPE (OR ALL FILES)? }
PROCEDURE INITTITLEREAD;
{ $P }
IMPLEMENTATION
VAR
  DISKNO,FILETYPE,PRINT: CHAR;
  DISKUNITS:SET OF CHAR;
  PRINTIT: BOOLEAN;
  NUMOFFILES,FILECOUNT,VOLNO,FILEID: INTEGER;
  PROCEDURE HALTDISPLAY;
```

(Continued on next page)



The eight-byte field allocated to the diskette title (or "volume name") starts in the seventh element of the character array with the first character specifying the length of the diskette title.

The field giving the total number of blocks available on an Apple Pascal diskette starts in the fifteenth element and the number of files currently in the directory is found in the seventeenth element of the character array into which block two is read.

The same format used for the file creation date associated with each entry in the directory is also used to store the current system date (i.e., the date associated with any newly written files). The current system date is stored starting in the twenty-first element of block two. The FILELIST procedure WRITESYSDATE should be called prior to creating new or updating existing disk files to set the current system date.

Conclusion

With an understanding of the way file directories are stored on disk, a variety of procedures could be developed to give Language System applications software users more control over vital program disk files. Beyond merely emulating existing F|iler program capabilities, new file maintenance capabilities could be developed: e.g., date-stamping compiled program listings, changing the date associated with existing directory entries and encoded prefixes and suffixes to allow longer, more meaningful file names.

It would be nice if Apple, Softech, or an ambitious reader would provide us with a 'fleshed out' library of units that emulated the capabilities of the Language System F|iler program. Until this happens, however, we must fend for ourselves. I hope this article will be of some use to those of you seeking to add file maintenance capabilities to your U.C.S.D. applications software.

Steven Lesh has programmed telecommunications computer system software for the last eight years. Programming became a hobby when the first microcomputers were marketed, though he still programs an old UNIVAC 9300 to support his habit. You can reach Mr. Lesh at General Delivery, Sierra Vista, AZ 85616.

Listing 1 (continued)

```

BEGIN
  WRITELN('PRESS ''C'' TO CONTINUE..');
  REPEAT
    READ(KEYBOARD,PRINT)
    UNTIL PRINT='C';
  END;
  { $P }
  PROCEDURE READDAT;
  TYPE
    { THESE SUBRANGES MUST BE ALLOWED TO ACCEPT '0' FOR }
    { INTERMEDIATE AND EXCEPTION PROCESSING           }
    DAYS=0..31;
    MONTHNMRS=0..12;
    YEARS=0..99;
  VAR
    DAYNUM:DAYS;
    MONTHNUM:MONTHNMPS;
    YEARNUM:YEARS;
    WORKAREA:INTEGER;
  BEGIN
    WORKAREA:=ORD(FIRSTDATECHAR);
    MONTHNUM:=WORKAREA MOD 16;
    IF WORKAREA > 15 THEN DAYNUM:=WORKAREA DIV 16
    ELSE DAYNUM:=0;
    WORKAREA:=ORD(LASTDATECHAR);
    IF ODD(WORKAREA)=TRUE THEN DAYNUM:=DAYNUM + 16;
    YEARNUM:=WORKAREA DIV 2;
    CASE MONTHNUM OF
      1:MONTH:='JAN';
      2:MONTH:='FEB';
      3:MONTH:='MAR';
      4:MONTH:='APR';
      5:MONTH:='MAY';
      6:MONTH:='JUN';
      7:MONTH:='JUL';
      8:MONTH:='AUG';
      9:MONTH:='SEP';
      10:MONTH:='OCT';
      11:MONTH:='NOV';
      12:MONTH:='DEC';
    END; { CASE MONTHNUM }
    STR(DAYNUM,DAY);
    STR(YEARNUM,YEAR);
  END;
  { $P }
  PROCEDURE TITLEREAD;
  CONST
    BLOCKSIZE=512;
    BOTTOMLINE=22;
    NUL=0;
    SOT=1;
    STX=2;
  VAR
    DATECHECKED,DATEFOUND,FIRSTBLOCK,MIDFILE,MIDTITLE:BOOLEAN;
    PRINT:CHAR;
    BLOCKTEXT:PACKED ARRAY[0..BLOCKSIZE] OF CHAR;
    TITLELINE:PACKED ARRAY[0..15] OF CHAR;
    BLOCKINDEX,DIRBLOCKINDEX,LINECOUNT,
    PRINTINDEX,DATEFINDER,TITLEINDEX,TITLELENGTH:INTEGER;
    DISPLAY:STRING[8];
  BEGIN
    IF PRINTTITLE=TRUE THEN DISPLAY:='PRINTER:'
    ELSE DISPLAY:='CONSOLE:';
    REWRITE(OUTPUTDEV,DISPLAY);
    DATECHECKED:=FALSE;
    FILECOUNT:=0;
    FIRSTBLOCK:=TRUE;
    LINECOUNT:=0;
    MIDFILE:=FALSE;
    MIDTITLE:=FALSE;
    FOR DIRBLOCKINDEX:= STARTDIR TO ENDDIR DO
    BEGIN
      UNITREAD(DISKUNIT,BLOCKTEXT,BLOCKSIZE,DIRBLOCKINDEX);
      IF FIRSTBLOCK=TRUE THEN
        BEGIN
          TITLELENGTH:=ORD(BLOCKTEXT[6]);
          BLOCKINDEX:=7;
          FOR TITLEINDEX:=1 TO TITLELENGTH DO
            BEGIN
              WRITE(OUTPUTDEV,BLOCKTEXT[BLOCKINDEX]);
              BLOCKINDEX:=BLOCKINDEX+1;
            END;
          WRITELN(OUTPUTDEV,':');
          NUMROFILES:=ORD(BLOCKTEXT[16]);
        END;
    END;
  END;

```

(continued)

Listing 1 (continued)

```
REPEAT { STEPPING THRU BLOCK }
  { FIND A FILE TITLE }
  WHILE (MIDFILE=FALSE) AND
    (BLOCKINDEX < BLOCKSIZE-2) AND
    NOT (BLOCKTEXT[BLOCKINDEX] IN
      [CHR(CODEFILE),CHR(TEXTFILE),CHR(DATAFILE)])
    DO BLOCKINDEX:=BLOCKINDEX+1;
  IF (MIDFILE=FALSE) AND
    (BLOCKINDEX < BLOCKSIZE-2) AND
    (BLOCKTEXT[BLOCKINDEX+1] = CHR(NUL)) THEN
    BEGIN
      { GET CHARACTER FOR TITLE LENGTH }
      TITLELENGTH:=ORD(BLOCKTEXT[BLOCKINDEX+2]);
      IF (TITLELENGTH > 0) AND
        (TITLELENGTH < 16) THEN FILECOUNT:=FILECOUNT+1;
      { IF FILE TITLE FOUND SET UP TO GET CHARACTERS }
      IF ((BLOCKTEXT[BLOCKINDEX] = CHR(FILETYPE)) OR
        (FILETYPE=ALLFILES)) THEN
      BEGIN
        IF (FIRSTBLOCK=FALSE) OR
          { THE NEXT CHECK PREVENTS A LOW BLOCK ADDRESS }
          { --FOR THE FIRST DIRECTORY ENTRY ONLY-- }
          { FROM BEING MISTAKEN FOR A FILETYPE BYTE }
          { >THIS IS NOT NORMALLY A PROBLEM FOR THE < }
          { >THIS IS NOT NORMALLY A PROBLEM FOR THE < }
          { >STANDARD PASCAL FILE TYPES UNLESS YOU < }
          { >REDUCE THE NUMBER OF BLOCKS ALLOCATED TO < }
          { >THE DIRECTORY OR USE THIS CODE WITH OTHER < }
          { >PASCAL-BASED LANGUAGES (E.G. PILOT) < }
        (FIRSTBLOCK=TRUE) AND (BLOCKINDEX > 29)) THEN
        BEGIN
          MIDTITLE:=TRUE;
          TITLEINDEX:=0;
          MIDFILE:=TRUE;
          BLOCKINDEX:=BLOCKINDEX+3;
        END;
      END;
    END;
  { GET FILE NAME FOR DISPLAY }
  WHILE (BLOCKINDEX < BLOCKSIZE-1) AND
    (MIDTITLE=TRUE) DO
  BEGIN
    REPEAT
      TITLELINE[TITLEINDEX]:=BLOCKTEXT[BLOCKINDEX];
      BLOCKINDEX:=BLOCKINDEX+1;
      TITLEINDEX:=TITLEINDEX+1
      UNTIL (TITLEINDEX-TITLELENGTH) OR
        (BLOCKINDEX=BLOCKSIZE);
    { SEE IF ANOTHER 'BLOCKREAD' REQD TO FINISH TITLE }
    IF TITLEINDEX = TITLELENGTH THEN
    BEGIN
      MIDTITLE:=FALSE;
      { POSITION TO END OF TITLE SPACE FOR SHORT TITLES }
      IF TITLEINDEX < 15 THEN
      BEGIN
        DATEFINDER:=15 - TITLELENGTH;
        BLOCKINDEX:=BLOCKINDEX + DATEFINDER;
        { DO THIS FOR SHORT TITLES ENDING ON A BLK BNDRY WITH }
        { UNUSED CHARS BEFORE THE DATE IN THE NEXT BLOCK }
        IF BLOCKINDEX > (BLOCKSIZE-2) THEN
          DATEFINDER:=BLOCKINDEX-BLOCKSIZE;
      END;
      { SET INDEX TO WHERE DATE 'STX' SHOULD BE }
      BLOCKINDEX:=BLOCKINDEX + 1;
    END;
  END;
  { FIND THE FILE CREATION DATE }
  WHILE (MIDFILE=TRUE) AND
    (BLOCKINDEX < BLOCKSIZE - 1) AND
    (DATECHECKED=FALSE) DO
  BEGIN
    DATEFOUND:=FALSE;
    { FOR TITLES WHICH END ON A BLOCK BOUNDARY }
    IF BLOCKINDEX=0 THEN BLOCKINDEX:=DATEFINDER+1;
    IF (BLOCKTEXT[BLOCKINDEX] IN
      [CHR(STX),CHR(SOT),CHR(NUL)]) THEN DATEFOUND:=TRUE
    ELSE
    REPEAT
      BLOCKINDEX:=BLOCKINDEX+1;
    UNTIL (BLOCKTEXT[BLOCKINDEX] IN [CHR(NUL),CHR(STX)]);
    IF (BLOCKTEXT[BLOCKINDEX] = CHR(STX)) THEN DATEFOUND:=TRUE;
    DATECHECKED:=TRUE;
  END;
  { DISPLAY A TITLE }
  IF (TITLEINDEX > 0) AND (DATECHECKED=TRUE) THEN
  BEGIN
    { PRINT FILE NAME }
    FOR PRINTINDEX:=0 TO TITLELENGTH-1 DO
      WRITE(OUTPUTDEV,TITLELINE[PRINTINDEX]);
    { TAB TO DATE-WRITE AREA }
    FOR PRINTINDEX:=0 TO 17-TITLELENGTH DO
      WRITE(OUTPUTDEV,' ');
    { CONVERT DATE FOR DISPLAY }
    IF DATEFOUND = TRUE THEN
    BEGIN
      READDATE(BLOCKTEXT[BLOCKINDEX+1],BLOCKTEXT[BLOCKINDEX+2],
        DAY,MONTH,YEAR);
      WRITE(OUTPUTDEV,DAY:2,'-',MONTH,'-',YEAR);
    END
    ELSE WRITE(OUTPUTDEV,'CAN''T FIND DATE');
    WRITELN(OUTPUTDEV);
    LINECOUNT:=LINECOUNT+1;
    DATECHECKED:=FALSE;
    MIDFILE:=FALSE;
    IF (LINECOUNT=BOTTOMLINE) AND (PRINTTITLE=FALSE) THEN
    BEGIN
      HALTDISPLAY;
      LINECOUNT:=0;
    END;
    { BUMP TO THE NEXT CHARACTER FOR CHECKS }
    IF MIDFILE=FALSE THEN BLOCKINDEX:=BLOCKINDEX+1;
    { IF WE HAVE PROCESSED ALL FILE TITLES ON THE }
    { DISK EXIT W.O. READING ALL DIRECTORY BLOCKS }
    IF FILECOUNT > (NUMROFILES-1) THEN
    BEGIN
      HALTDISPLAY;
      CLOSE(OUTPUTDEV,NORMAL);
      EXIT(TITLEREAD);
    END;
    { END REPEAT BLOCK STEPPING }
    UNTIL BLOCKINDEX > BLOCKSIZE -1;
    FIRSTBLOCK:=FALSE;
  END; { FOR DIRBLOCKINDEX:= STARTDIR TO ENDDIR }
  CLOSE(OUTPUTDEV,NORMAL);
  { ALLOW TIME TO READ LAST SCREEN }
  HALTDISPLAY;
END;
PROCEDURE INITTITLEREAD;
BEGIN
  REPEAT
    DISKUNITS:=['1'..'6'];
    PAGE(INPUT);
    REPEAT
      WRITELN('TYPE ''P'' FOR HARDCOPY;');
      WRITELN('''S'' FOR SCREEN OUTPUT..');
      READ(KEYBOARD,PRINT)
      UNTIL PRINT IN ['P','S'];
      IF PRINT='P' THEN PRINTIT:=TRUE
      ELSE PRINTIT:=FALSE;
    REPEAT
      WRITELN('LIST TEXT FILE DIRECTORY FOR WHICH DISK?');
      WRITELN('**TYPE 1-6..');
      READ(KEYBOARD,DISKNO)
      UNTIL DISKNO IN DISKUNITS;
    CASE DISKNO OF
      '1':VOLNO:=4;
      '2':VOLNO:=5;
      '3':VOLNO:=9;
      '4':VOLNO:=10;
      '5':VOLNO:=11;
      '6':VOLNO:=12;
    END { CASE DISKNO };
    REPEAT
      WRITELN('ENTER FILE TYPE..');
      WRITELN(' 0 -> ALL FILE TYPES');
      WRITELN(' 2 -> CODE FILES');
      WRITELN(' 3 -> TEXT FILES');
      WRITELN(' 5 -> DATA FILES');
      WRITELN(' 9 -> **QUIT**');
      READ(KEYBOARD,FILETYPE);
      UNTIL FILETYPE IN ['0','2','3','5','9'];
    CASE FILETYPE OF
      '0':FILEID:=0;
      '2':FILEID:=2;
      '3':FILEID:=3;
      '5':FILEID:=5;
      '9':FILEID:=9;
    END { CASE FILETYPE };
    IF FILEID < 6 THEN TITLEREAD(VOLNO,FILEID,PRINTIT);
  UNTIL FILEID=9;
END;
BEGIN
  END.
```

(continued)



Alspa Computer, Inc.

The price-performance leader. Includes Z80A, 1 or 2 full 8" drives (double density, double sided), 3 serial and 1 parallel port, and Winchester port. Prices start at less than \$2000. Networking Available. **DEALER / OEM** inquiries invited.

SPECIALS on INTEGRATED CIRCUITS

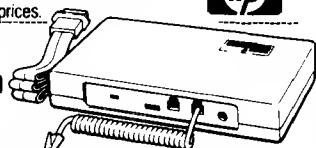
6502	7.45	10/ 6.95	50/ 6.55	100/ 6.15
6520 PIA	5.15	10/ 4.90	50/ 4.45	100/ 4.15
6522 VIA	6.45	10/ 6.10	50/ 5.75	100/ 5.45
6532	7.90	10/ 7.40	50/ 7.00	100/ 6.60
2114-L300		1.95	25/ 1.85	100/ 1.75
2716 EPROM		5.90	5/ 5.75	10/ 5.50
2532 EPROM		6.90	5/ 6.45	10/ 5.90
6116 2Kx8 CMOS RAM		5.90	5/ 5.45	10/ 5.10
4116 RAM			8 for 14	
Zero Insertion Force 24 pin Socket (Scanbe)				2.00

Hewlett Packard

Write or call for prices.



**Anchor
Automation
Signalman
Modems**



FREE SOURCE MEMBERSHIP WITH SIGNALMAN

All Signalman Modems are Direct Connect, and include cables to connect to your computer and to the telephone. Signalman Modems provide the best price-performance values, and start at less than \$100. **Dealer and OEM** inquiries invited

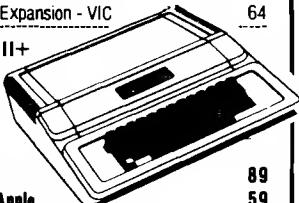
Mark I RS232	(99)	79
Mark II for Atari 850	(99)	79
Mark IV for CBM/PET with software	(169)	99
Mark V for Osborne (software available)	(129)	93
Mark VI for IBM Personal Computer	(250)	180
Mark VII Auto Dial/Auto Answer	(179)	119
Mark VIII Bell 212 Auto/Answer	(399)	319

DC HAYES Smartmodem	219
DC Hayes Smartmodem 1200	545



Apple Emulator for Commodore 64	89
Scroomaker 80 COLUMN CARO for C64	149
FROGGER for C64 or VIC	25
Solid Oak 2 Level Stand for C64 or VIC	29
C64/VIC Switch (networking)	125
BACKUP V1.0 tape copier for C64 or VIC	20
CARDBOARD/6 Motherboard - VIC	79
CARDAPTER/1 Atari VCS Adapter - VIC	69
CARDPRINT Printer Interface - C64/VIC	64
CARDBOARD/3s Motherboard - VIC	32
CARDETTE/1 Cassette Interface - C64/VIC	32
CARDRITER Lightpen - C64/VIC	32
CARDRAM/16 RAM Expansion - VIC	64

We carry Apple II+ from
Bell & Howell



Apple Emulator for Commodore 64	89
16K RAM Card for Apple	59
Solid Oak 2 Level Stand for Apple	29
Super Serial Card	149
MPC RAM/80 column card for IIE	139
Z80 Softcard and CP/M (Microsoft)	235
Parallel Printer Interface/Cable	79
Apple Dumping (Microtek) Printer Interface	115
Apple Dumping with 16K Buffer	160
Grappler + Interface	140
TG Products for Apple in stock	
DC Hayes Micromodem II	299
VIDEX 80 Column Card	239
Hayden Software for Apple 20% OFF	
PIE Writer Word Processor	120

215-822-7727

252 Bethlehem Pike
Colmar, PA 18915

A B Computers

commodore

See us for Personal, Business, and Educational requirements. Educational Discounts available.

PETSCAN \$245 base price

Allows you to connect up to 30 CBM/PET Computers to shared disk drives and printers. Completely transparent to the user. Perfect for schools or multiple word processing configurations. Base configuration supports 2 computers. Additional computer hookups \$100 each.

CBC / PET / C64 COMMUNICATIONS!

COMPACK \$115

Intelligent Terminal Package

ACIA Hardware / STCP Software

VE-2 IEEE to Parallel Interface 110

Includes case, power supply, full 8-bit transmission, and switch, selectable character conversion to ASCII.

VIDEO ENHANCER for Commodore 64 89

Realize video quality equal or better than composite monitor using standard color TV.

SCREENMAKER 80 Column Adapter for C64 149

Provides big screen capability for business applications.

VIC 20 Products

VIC Sargon II Chess 32

VIC GORF 32

VIC RAM Cards in stock

Meteor Run (UMI) 39

VIC SuperExpander 52

VIC Radar Ratrace 24

VIC 16K RAM 95

Amok (UMI) 20

Thorn EMI Software

Snakman 15

HES Software

Rubik's Cube 13

VIC Omega Race 32

Programmers Reference 15

Spiders of Mars (UMI) 39

FROGGER 25

Programmers Aid 45

VIC Adventure Series

VICTORY Software for VIC and C64

Street Sweepers 12

Maze in 3-D 12

Night Rider 11

Cosmic Debris 12

Treasures of Bat Cave 12

Grave Robbers Advent. 11

Games Pack I 12

Games Pack II 12

Victory Casino 8

Adventure Pack I 12

Adventure Pack II 12

Trek 11

Commodore 64 Programmers Reference Guide 16

MicroChess for C64 or PET 19

Compute's First Book of PET/CBM 11

C64 or VIC SWITCH 125

POWER ROM Utilities for PET/CBM 78

WordPro 3+64 69

WordPro 4+ - 8032, disk, printer 295

SPELLMASTER spelling checker for WordPro 170

VISICALC for PET, ATARI, or Apple 189

PETRAX PET to Epson Graphics Software 40

SM-KIT enhanced PET/CBM ROM Utilities 40

Programmers Toolkit - PET ROM Utilities 35

CALC RESULT for C64 135

PET Spacemaker II ROM Switch 36

COPYWRITER Word Processor for C64 69

2 Meter PET to IEEE or IEEE to IEEE Cable 40

Dust Cover for PET, CBM, 4040, or 8050 8

CmC Interfaces (ADA1800, ADA1450, SAD) in stock

ZRAM - CBM 64K RAM, Z80, CP/M 550

Programming the PET/CBM (Compele) — R. West 20

Compute! First Book of VIC 11

Whole PET Catalog (Midnight Gazette) 8

PET Fun and Games (Cursor) 11

Color Chart Video Board for PET 125

FlexFile for PET CBM, C64 \$110

Database, Report Writer with calculations, Mailing Lists.

FORTH for PET full FIG model — Cargill/Riley \$50

Metacompiler for FORTH for independent object code 30

KMMM PASCAL for PET/CBM 85

EARL for PET/CBM Disk-based ASSEMBLER 65

Super Graphics — BASIC Language Extensions 45

Fast machine language graphics routines for PET/CBM

RAM/ROM for PET/CBM 4K \$75 8K \$90

DISK ICU — Recovery System for PET/CBM 40

DISK SPECIALS

Scotch (3M) 5" ss/dd	10/ 2.25	50/ 2.10	100/ 2.05
Scotch (3M) 5" ds/dd	10/ 3.15	50/ 2.90	100/ 2.85
Scotch (3M) 8" ss/sd	10/ 2.40	50/ 2.20	100/ 2.15
Scotch (3M) 8" ss/dd	10/ 2.95	50/ 2.70	100/ 2.65

We stock VERBATIM DISKS

Write for Dealer and OEM prices.

BASF 5" or 8"	10/ 2.00	20/ 1.95	100/ 1.85
NEW BASF Qualimetric Disks also in stock.			
Wabash 5" ss/sd	10/ 1.80	50/ 1.75	100/ 1.70
Wabash 5" ss/dd	10/ 2.00	50/ 1.95	100/ 1.90
Wabash 8" ss/sd	10/ 2.00	50/ 1.95	100/ 1.90

We stock MAXELL DISKS

Write for dealer and OEM prices.

Disk Storage Pages	10 for \$5	Hub Rings 50 for \$6
Disk Library Cases	8" — 3.00	5" — 2.25
Head Cleaning Kits	11	

CASSETTES—AGFA PE-611 PREMIUM

C-10	10/ 61	50/ 58	100/ 50
C-30	10/ .85	50/ .82	100/ .70

OATASHIELD BACKUP POWER SOURCE 225

Battery back up Uninterruptible Power Supply with surge and noise filtering. The answer to your power problems.

Zenith ZVM-121 Green Phosphor Monitor 100

BMC 12A 12" Green Monitor 80

VOTRAX Personal Speech System 280

VOTRAX Type-N-Talk 160

VOICE BOX Speech Synthesizer (Apple or Atari) 32

CompuServe Subscription (5 hours free) 389

Prowriter Parallel Printer 1050

Daisywriter 2000 Many printers available (Star, Brother, OKI, etc.)

We Stock AMOEKO Monitors

Amdtek DXY-100 Plotter 600

A P Products 15% OFF

Watanabe Intelligent Plotter 990 6-pen 1290

ISOBAR 4 Outlet Surge Suppressor/Noise Filter 49

We stock Electrohome Monitors

dBASE II (8" format) 325

ALL BOOK and SOFTWARE PRICES DISCOUNTED

Panasonic TR-120M1P 12" Monitor (20 MHz) 149

Panasonic CT-160 Dual Mode Color Monitor 285

USI Video Monitors—Green or AMBER 20 MHz Hi-res.

Dealer and OEM Inquiries invited

Synertek SYM-1 Microcomputer SALE 189

KTM-2/80 Synertek Video and Keyboard 349

ZENITH	data	systems
Z29 Terminal (new detachable keyboard)	680	
ZT-1 Intelligent Communications Terminal	369	
Z100 16-bit/8-bit Systems in stock	CALL	

We stock entire Zenith line



WE STOCK ENTIRE LINE—write for prices.

Atari 1200 549 QIX 34

Voice Box 100 Anchor Modem—Atari 79

FROGGER 25 Atari Graphics (Compute) 11

First Book of Atari 11

APX Software

EdiFax Software

WRITE FOR CATALOG. Add \$1.50 per order for United Parcel

We pay balance of UPS surface shipping charges on all prepaid orders

Add extra for mail (APO FPO, air). Prices include cash discount

Regular prices slightly higher. Prices subject to change

COMPU \$ENSE

C-64	Compute	\$399.00
VIC-20®	Personal Computer	147.00
VIC-1515	Printer	334.95
VIC-1530	Datasette	67.50
VIC-1541	Disk Drive	347.00
VIC-1010	Expansion Module	139.95
VIC-1311	Joystick	9.95
VIC-1312	Game Paddles	19.95
	Telephone Modem	99.95
VIC-1210	VIC 3K Memory Expander Cart.	34.95
	Plugs directly into the VIC's expansion port. Expands to 8K RAM total.	
VIC-1110	VIC 8K Memory Expander Cart.	52.50
	8K RAM expansion cartridge plugs directly into the VIC.	
CM102	24K Memory Expander Cart.	119.95
VIC-1011A	RS232C Terminal Interface	39.95
	Provides interface between the VIC-20 and RS232 telecommunications	
	modems. Connects to VIC's user port.	
PETSPEED	- Basic Compiler for Commodore	140.00
	Compile any Pet Basic program. The only optimizing compiler. Programs	
	compiled with Petspeed run up to 40 times faster. Petspeed code is unlistable	
	and compiled programs cannot be tampered with. No security device required	
	for compiled programs. Available NOW for the Commodore 64.	
Star Gemini 10 Printer		360.00
Star Gemini 15 Printer		450.00
SND Monitor		347.00

CS1 **QUICK BROWN FOX** \$55.00

The Word Processor of this decade! For the VIC-20 and C-64.

COMMODORE SOFTWARE

VIC-1211A	VIC-20 Super Expander	\$55.00
	Everything Commodore could pack into one cartridge - 3K RAM memory	
	expansion, high resolution graphics plotting, color, paint and sound commands. Graphic, text, multicolor and music modes. 1024x1024 dot screen plotting. All commands may be typed as new BASIC commands or accessed by hitting one of the VIC's special function keys. Includes tutorial instruction book. Excellent for all programming levels.	
VIC-1212	Programmer's Aid Cartridge	\$45.99
	More than 20 new BASIC commands help new and experienced programmers renumber, trace and edit BASIC programs. Trace any program line-by-line as it executes, pause to edit. Special KEY command lets programmers redefine function keys as BASIC commands, subroutines or new commands.	
VIC-1213	VICMON Machine Language Monitor	\$48.99
	Helps machine code programmers write fast, efficient 6502 assembly language programs. Includes one line assembler/disassembler.	

CARDCO

Atari Adapter	- play your 2600 games on the VIC-20	\$79.95
CARDBOARD 6		\$87.50
	An expansion interface for the VIC-20. Allows expansion to 40K or accepts up to six games. May be daisy-chained for more versatility.	
CARDBOARD 3		\$35.95
	Economy expansion interface for the Vic-20	
CARD "?" CARD/PRINT		\$76.00
	Universal Centronics Parallel Printer Interface for the VIC-20 or CBM-64. Use an Epson MX-80 or OKIDATA or TANDY or just about any other.	
CARDETTE		\$30.95
	Use any standard cassette player/recorder with your VIC-20 or CBM-64.	
LIGHT PEN		\$29.95
	A light pen with six good programs to use with your VIC-20 or CBM-64.	
16K Memory Expander		\$50.50

All CARDCO Products have a lifetime warranty.

BUSINESS USES FOR YOUR VIC-20®

SS	Accounts Payable & Receivable	\$29.95
CW-107A	Home Calculation Program Pack	48.95
CPV-31	Data Files - your storage is unlimited	14.95
CPV-96	Household Finance Package - to keep records of all your household expenses	30.95
CPV-208	Bar-Chart - display your numerical data	8.95
CH	Turtle Graphics - learn programming	34.95
CH	VIC Forth - a powerful language for BASIC programming	49.95
CH	HES MON - a 6502 machine language monitor with a mini-assembler	34.95
CH	HES Writer - time-saving word process tool	34.95
CT-21	Encoder - keep your personal records away from prying eyes	34.95
CT-121	Statistics Sadistics - statistical analysis	14.95
CT-124	Total Time Manager 2.0 - creates personal or business schedules	15.95
CT-125	Totl Label - a mailing list & label program	13.95
CT-126	Totl Text BASIC	15.95
CT-140	Research Assistant - keep track of data	17.50
CM-152	Totl Text Enhanced	29.95
CQ-5	Grafix Designer - design graphic characters	12.95
CS	Minimon - allows you to program, load, save, or execute machine language programs	13.95
CS	Home Inventory - lists your belongings	17.95
CS	Check Minder - keep your checkbook right	14.95
	General Ledger - a complete ledger	19.95

GAMES FOR YOUR VIC-20®

CH-G203	Tank Wars	\$15.95
CH-G205	Pinball	13.45
CH-G206	Simon - it gets tougher as you get better. Great for kids of all ages.	13.45
CH-G207	Fuel Pirates	13.45
CH-G209	Laser Blitz	15.95
CH-G210	Tank Trap	15.95
CH-G211	Concentration	13.45
CH-G212	Dam Bomber - pilot the plane, avoid enemy	13.45
CH-C307	Shamus - search room after room for the shadow-eluding androids; 2 levels of intense arcade action	34.95
CH-C308	Protector	36.95
CPU-79	Breakout	7.95
CPU-85	Hangman - unbelievable graphics & sound	9.95
CPU-87	Memory - VIC challenges your memory	9.95
CPU-88	Match - hand & eye coordination	7.95
CPU-89	Monks - a devilish game of logic	7.95
CPU-108	Bomber - you must decide who you want to fly for, then pick a target & your experience level	9.95
CPU-109	Amok - the halls of Amok are populated by robots that obey one command - get the intruder!	20.95
CPU-153	Tank vs. UFO - the tank is moving back & forth along the base; shoot the UFO before it shoots you	9.95
CPU-194	Snakman - Pacman for the VIC	14.95
	Defender on Tri - you're the pilot of an experimental ship	17.95
	3-D Man - the popular arcade game, requires 3K	17.95
	Exterminator - a game full of bugs	20.95

We have over 400 programs for your VIC-20 and over 250 programs for your C-64!

Shipping & Handling Charges:

First two (2) items - \$2.00 per item.
 Three (3) or more items - \$1.00 per item.
 For orders over \$100 total, surface shipping will be paid by CompuSense. Blue Label or special handling will be paid by the customer.
 Additional \$2.00 C.O.D. fee on all C.O.D. orders.
 MasterCard and Visa accepted. Give card number and expiration date on order form.
 Allow three (3) weeks for personal checks.

TO ORDER:

P.O. Box 18765
 Wichita, KS 67218
 (316) 263-1095



Prices subject to change.
 VIC-20® is a registered trademark of Commodore

**Write for
 FREE
 Catalog!**

Circle No. 24

When something new comes along most of us tend to be conservative about giving up the familiar. A good example of this behavior is the use of structured programming languages on microcomputers. Languages like Pascal have been available to us for a couple of years; they are easier to program in and more efficient than BASIC. However, only a relative minority of microcomputer users have switched to a structured language, and none of the major manufacturers offer anything other than BASIC as standard equipment.

Recently a number of new operating systems have come on the market. These operating systems bear about the

There are different types of tree structures used in structured programming and as data structures. I will restrict my discussion to one particular type: the hierarchical structure. In this structure the root node is called the ancestor of all other nodes. The next lower level of nodes are the children of the root node, each of which may have children of its own. As you work down the tree, each level of nodes represents a new generation of children. Each node has only one parent node, but it may have any number of child nodes. A path from the root node to any other node in the structure is simply a list of descendants, starting with the root

BASIC-09 needed an equally well-structured operating system to support it, developed OS-9 to allow BASIC-09 users realize the full potential of a modern programming language.

I feel OS-9 is the best of the new operating systems. It is one of the most powerful 8-bit operating systems available today and is the only truly powerful operating system that can run on a relatively small system. A 24K-byte system can support OS-9, and 48K system can run several users simultaneously in a high-level language. A fully extended OS-9 system can have 1 megabyte of main memory, hard disk drives, and many users.



a structured operating system

by Mark G. Boyd

same relationship to the currently dominant systems [CP/M, Apple DOS, Flex] as Pascal does to BASIC. They are more powerful and, usually, easier to use.

Structured operating systems have the same type of structure found in a structured program, looking like an upside-down tree. The highest level is called the root node and is the overall control structure and most abstract part of the system. The root node is connected to the highest level of branch nodes, each of which are connected to their own set of branch nodes on the next lower level. On any level, a node may not be connected to any lower-level nodes. This type of node is called a leaf node and is connected only to a single branch node on the next higher level. In a structured program the leaf nodes are the most detailed part of the program. In a structured operating system they are the I/O device drivers, the data files, and the lowest level routines in the programs.

node and ending with the desired node. The path from the root node to any other node is unique. Any node may be reached from any other node by working up the structure until a common ancestor node is found and then working down to the desired node.

Data flow in a hierarchical structure is allowed only along the paths connecting the nodes. All data is local to the procedures/files that are the nodes. Data may be passed from a parent to its child or from a child to its parent; it cannot be passed to any other node without working through a path that involves a common ancestor. This system sounds complex but, as you shall see, it is the basis for very simple, but powerful operating systems.

OS-9, which uses this hierarchical structure and is a by-product of BASIC-09, is a result of Motorola's 6809 development process. The software was developed simultaneously with the hardware it is designed to use. Motorola and Microware, realizing that

A Structured Operating System

OS-9 is a descendant of UNIX, the Bell Telephone Laboratories operating system for large minicomputer systems. UNIX has become the standard for multiprogramming minicomputer systems because of its versatility, power, and elegantly simple design. OS-9 looks much like UNIX, but its actual operation is quite different. UNIX dynamically swaps programs into memory from large, fast disk systems. OS-9 cannot do this because of the slow disk systems used with microcomputers. In order to support multiple users, OS-9 makes use of position-independent re-entrant programs in RAM or ROM. Because the programs are re-entrant, multiple users can use the same code while maintaining different data and stack areas, and because the code is position independent, it can be brought into memory, in any available location, as needed. These two factors allow OS-9 to be

much more efficient in its use of RAM and ROM than UNIX.

Multiprogramming means that the system can execute many different programs simultaneously. CPU time is divided in time slices (about .1 seconds in OS-9), which are allocated by the system to the various tasks currently running and to the operating system overhead. With a powerful microprocessor like the 6809 and a well-designed multiprogramming operating system like OS-9, users are not aware that they have only part of the CPU time.

OS-9 can run processes sequentially or concurrently. Each process is created by an existing process and may in turn create child processes of its own. This leads to a hierarchical structure where all processes are descendants of the original process run when OS-9 was brought up. To the user the root of each tree of processes is a process called Shell. A Shell process is executed when the system is started, and a new incarnation of Shell is created for each user who logs onto the system. Shell is a command interpreter that accepts input from the user and creates new processes in response to that input. Shell also can pass parameters to the process it creates.

When a Shell creates a process it puts itself into a waiting state until that process is finished. The user has the option of causing the Shell to create another incarnation of itself before it goes into its waiting state. This new Shell then can be used to create a new process and another incarnation of Shell, allowing a single user to make effective use of OS-9's multiprogramming capabilities. I'll give an example of this at the end of the article.

A hierarchical system also is used for all input and output. The top level (or root) of this tree is a general I/O manager. At this level all data is essentially a stream of bytes. Data being sent out to an external device passes down through the tree to a device driver, which is a leaf node (for single file devices) or the root node of the device file structure (for disk drives). The characteristics required for the data actually sent to the device are added as it passes down the tree. For example, data going to the disk would be blocked to sector size at one level, the appropriate preamble and postamble added at another level, and the actual sectors to be written determined at yet another

level. Input data undergoes the reverse of this process as it passes up the tree. Data at the top, which is the data passed to or from a process, has the same structure regardless of its course or its destination.

The device independence of I/O data has two advantages. First, it means that I/O paths can be redirected at any time. A program that normally outputs to the printer can have its output redirected to a disk file for later printing. Input to the Shell can be redirected to allow a disk file to control the system. In other words, printer spooling and procedure files are inherent in OS-9. Second, OS-9 programs are essentially hardware independent. The program is not aware of the device driver modules, so it cannot depend on the details of the I/O hardware. A program that runs on a small OS-9 system with one minifloppy and a serial printer will run, without modification, on a large system with hard disks and a chain printer. No more problems with software transportability or system upgrades!

The hierarchical structure extends to the file structure on the disk drive(s). A file is accessed by specifying a path to it. This path is simply a list of all of its direct ancestors. Each entry in the list, except for the first and last, is a directory file. Directory files are the branch nodes of the tree structure and contain only the names of their immediate descendants and pointers to them. The leaf nodes of the tree are the actual data or program files. The first entry in the path list may be a device driver (e.g., /D1) or it may be a directory file in the current directory. The last entry is the name of the desired file. If the desired file is in the current directory, only the last entry is required.

Finally, let's explore some Shell commands. These commands are entered in response to the prompt OS9 and consist of a process name that may be followed by parameters for the process, a parameter that modifies the amount of memory used by the process, parameters that redirect the input/output paths of the process, and finally by a parameter that results in concurrent processing (i.e., creates a new incarnation of Shell). The parameters are separated by spaces and the entry is terminated by a return. Some examples are:

1. OS9: LIST FILE 7
2. OS9: COPY FILE3 FILE7

3. OS9: LIST /D1/ASSM-FILES/BPROM
4. OS9: LIST /D0/MARK-LIB/LETTER>/P1
5. OS9: LIST FILE7>/P1 & EXECUTE #7K

The first example runs the process LIST with input from FILE7, which lists FILE7 to the terminal. The second example runs the process COPY with input from FILE3 and output to FILE7. So far things are much the same as in any DOS.

The third example runs the process LIST. Input is from the file BPROM. The path list specifies that BPROM is listed in the directory file ASSM-FILES, which itself is listed in the primary directory for the disk mounted in drive D1. The fourth example is similar to the third but it also demonstrates output redirection (>) to the serial printer driver /P1. This process lists the file LETTER to the serial printer.

The fifth example introduces concurrent execution (&). The Shell creates a process that starts listing FILE7 to the printer. Then it creates another Shell that starts the process EXECUTE (EXECUTE is allocated 7K of RAM (#7K)). All processes have a certain minimum amount of RAM that they require. This information is stored on the disk with each process. The #7K is an execution modifier that can be used to allocate larger amounts of RAM at the time the process is created.

On my system EXECUTE is a BASIC-09 program. This information is noted by the system and, when a process using EXECUTE is created, BASIC-09 is loaded automatically and instructed to run the process. EXECUTE must be in packed form and located in the CMDS directory, but that's a subject for another article.

References

1. OS-9 Level I Operating System V1.1 Users Guide, Microwave Systems Corporation, 1981.
2. OS-9 Level I Operating System V1.1 System Programmer's Manual, Microwave Systems Corporation, 1981.

Dr. Boyd teaches chemistry, physics, and computer science at a small liberal arts college. He may be contacted at St. Mary of the Plains College, Dodge City, KS 67801.

Color Disk

BASIC: observations and utilities

By Michael Budgen and William Clements, Jr.

The disk system for the Color Computer (CoCo) has been available for over a year now and has proved to be quite popular with CoCo owners. The DOS is ready to go at power-up, doesn't tie up a disk drive in reading program overlays, and since it is in ROM, it can't be overwritten by some renegade program. Best of all, it is easy to use; the commands are simple and direct, with many being easily understood by a complete novice.

In the year that we've used the CoCo DOS, we have discovered a few things that aren't specifically documented by Radio Shack, and have written some utility programs that we'd like to pass along to other disk users. We'll also discuss the structural details of BASIC and machine-language program files on disk. With this information, you can create new files, or modify old ones, directly from the keyboard. You can scroll through a file, or even through an entire disk, and explore the contents on the disk. You can back up the directories on all your disks, using sectors that are "hidden" from the operating system, as a safeguard against directory crashes that can help in recovering accidentally KILLED files. You can list to the screen a complete summary of granules and sectors that a file occupies, and you can change individual bytes within a file without rewriting the whole file. Finally, we'll give you a program that lets you print a disk directory in a compact file-list table, including the start, end,

and exec addresses for machine-language files, appropriate for taping onto the disk jacket.

Disk Format and File Structure

There are three separate parts to a program file: the directory entry, the file-allocation table entries, and the file data. The disk is formatted into 35 tracks, with eighteen 256-byte sectors per track. The directory is contained on sectors 3-11 of track 17, and the file-allocation table is on sector 2 of the same track. Sectors 1 and 12-18 of track 17 are not used by the DOS.

Each track is divided into two 4096 byte granules, sectors 1-9 comprising one granule and sectors 10-18 the other. The granules are numbered 0 (track 0, sectors 1-9) through 31 (track 16, sectors 10-18), and 32 (track 18, sectors 1-9) through 67 (track 34, sectors 10-18), skipping the directory track. The directory is located in the middle of the disk to minimize head travel; the directory must always be accessed first when program file operations are carried out by BASIC, and then the sectors containing the actual file are read.

The Directory Format

The directory structure is completely documented on pages 58-59 of the Disk System Owner's Manual and Programming Guide, so we won't repeat every detail here. The directory entries

are contained in the first 16 bytes of each 32-byte cluster — beginning in sector 3 of track 17 and stored in the same order that the files were originally created on the disk. Each entry contains file name and extension, a file-type flag, a binary/ASCII flag, the number of the first granule in the file, and the number of bytes used in the last sector of the file.

Sector 2 of the directory track is the file-allocation table, which uses bytes 0-67. Each byte indicates the type of use being made of the granule having the same number as the byte. A value \$FF means that granule is not part of a file. A value in the range \$0-\$43 (0-67 base ten) means that granule is part of a file; the value contained there is the number of the next granule used by the file. A value in the range \$C0-\$C9 means the corresponding granule is the last one used by that file. The second hex digit (0-9) is the number of sectors in the granule that the file uses, counting from the first sector in the granule. Note that the four lowest order bits (bits 0-3) in the word therefore give the number of sectors, rather than bits 0-5 as the manual says. Table entries in the range \$0-\$43 and \$C0-\$C9 form a linked list of the granule allocations to every file.

When a file is killed, the first character of the file name is set to \$FF, and the entries in the allocation table that correspond to the granules containing the file are also set to \$FF. This destroys all information explaining where a file was stored. The file itself is left unchanged and will be overwritten by new data if the sectors are re-used. The FREE function of BASIC reports the number of table entries in the allocation table that currently equal \$FF.

How Program Files Are Stored

Let's look at how a BASIC program is stored in RAM, as a binary file on disk, and as an ASCII disk file. For our example, we'll choose a simple two-line program:

```
10 INPUT A  
20 PRINT A;SQR(A):GO TO 10
```

BASIC stores its program lines in tokenized form, replacing all commands and functions with a one-byte code as the lines are entered. The interpretation of lines thus starts even before a program is run, saving some execution time and using less memory.

TABLE 1. RAM STORAGE OF BASIC TOKENIZED LINES

The pointer to the first location used for the lines is in locations \$19-\$1A. The lines are stored in the following format: two-byte address of next BASIC line, two-byte line number, the BASIC tokenized line, and a one-byte end-of-line marker (\$00).

Example: 10 INPUT A
20 PRINT A, SQR(a) : GO TO 10

We find that \$19-\$1A contains \$2601. At \$2601, we find the following data:

Hex Loc.	Hex Byte	Comments	Hex Loc.	Hex Byte	Comments
\$2601	26	Next line	\$2610	3B	;
	09	at \$2609		FF	Function flag
	00			9B	SQR token
	0A	Line #10		28	{
	89	INPUT token		41	A
	20	Space		29	}
	41	A		3A	.
	00	End-line marker		81	Token for GO
	26	Another line		20	Space
	1E	would go here		A5	Token for TO
\$2609	00			20	Space
	14	Line #20		31	1
	87	PRINT token		30	0
	20	Space		00	End-line
	41	A			marker

disk programs. When the computer is powered up, the initialization routines put a table of pointers to the BASIC functions and commands into lower RAM starting at \$0120. If you have the Extended BASIC ROM, the pointers to those additional keywords are added to the table, and if the disk system is plugged in, pointers to the disk command and function lists are appended. Be sure the disk controller pack is plugged in if you save a program containing Disk BASIC statements onto cassette tape! Likewise, the disk pack must be in place whenever you read that tape back in. Otherwise, the table of pointers to legal keywords won't contain the ones for Disk BASIC. When you try to list a program containing unrecognizable tokens, BASIC goes ahead with the list but prints an exclamation point in place of the offending tokens as a signal that it couldn't figure out what keyword to put there.

BASIC uses a slightly different format to store machine-language programs, since several absolute addresses must be associated with each file. Table 4 gives a six-byte test program and shows how it is stored. Notice that the end address is not stored with the file; the start address and total number of program bytes are saved at the front of the program, and the execute address appears at the end.

Saving Disk Programs On Cassette

While we're talking about storage of Disk BASIC programs, here is a word of caution about the cassette storage of

ROM must be there before a CoCo can understand your tape!

Some Utility Programs For the Disk User

Now that we know the exact form in which the disk system stores programs, we can go in directly and alter the directory, fix a bad byte in the middle of a program, or construct our own files by POKEing in directory entries and file sectors directly from a program. We could even convert a BASIC program file into a machine-language file, and *vice versa*, by properly modifying the directory entry and changing the marker bytes at the beginning and end of the file. Many of these tricks are useful if you need to salvage a damaged file or a miswritten directory. The latter conversion might be helpful in overlaying or chaining program segments that have conflicting numbers by reading a BASIC file into a section of unused RAM and POKEing new line numbers into the statements. Then, by using a machine-language merge and move routine, you can combine them with the original program. Or you can just use the programs as an aid in learning about how Disk BASIC works.

1. The DISKLOOK Program. Listing 1 presents a multipurpose utility for examining and changing all kinds of files, including the directory itself. The program begins in the "disklook" mode, requesting a granule number and a sector number. When that information is

provided, the program reads the sector into memory. Beginning with the first byte in the sector and continuing until the screen is full, it prints the byte count, the hex value of the byte and its ASCII character equivalent. To continue scrolling through the contents of the sector, press the space bar or 'enter'. To reverse-scroll, hit the up-arrow; to interrupt the scrolling and specify another granule and sector, press '@'. If you wish to look at the directory, enter 'D' instead of a granule number. The byte count starts at 0 when the directory is read out, to correspond with the listings in the Disk System Manual and to allow the byte numbers in the allocation table to correspond with the granule numbers. For all other granules, the bytes are numbered starting with 1.

You may also enter a subcommand mode whenever the screen stops scrolling. A 'D' key initiates a search through the directory sectors for the first unused position. Then you are prompted for the information needed to create a new directory entry (you must use as the extension either .BAS, .BIN, or .TXT). A 'C' allows you to change one byte in the sector under examination by specifying the byte number and the new value. An 'F' (for file-analysis) prompts for a file name, then lists all information contained in the directory about that file, including file type and mode, an ordered list of the granules used, the number of sectors in the last granule, and the number of bytes in the last sector.

2. The DIRDUPL Program. If you read the Disk System Manual carefully, you'll see that BASIC leaves nearly half the directory track unused. Sectors 1 and 12-18 can be used for other purposes, such as scratch storage or private files. We use them to back up the information contained in the directory. Most disk users at one time or another have gotten a mangled directory due to power failure, a power-line spike, or other mishap that occurs just as you are writing the disk. Another cause of crashed disks is the corrosion that forms on the contact fingers of the disk drive, causing intermittent connections.

You can use DIRDUPL to back up directory sectors 2-9 into sectors 12-18 and 1, respectively, and then later to rewrite the directory from the backup if it ever becomes necessary. Sectors 10 and 11 are not backed up due to lack of space; however, these are not normally

used unless you have more than 54 files on one disk.

By the way, DIRDUPL can provide an easy way to restore a killed file. The KILL command doesn't alter the file, it just flags the directory entry and wipes out that file's granule numbers in the file-allocation table so they all can be used again. If you kill a file and want to recover it later, you can do so by restoring the original directory provided that none of the file's granules have been reused. Of course, if the file space has been overwritten, the original file is unrecoverable by any method.

3. The DISKLST Program. Several programs have been published that give

a printed listing of the names/extension, length, type, addresses, and other statistics associated with the files on a disk. The most elaborate file statistics we've seen are those generated by F. S. Flack's program in *Color Computer News*, August, 1982, p. 11. Another program giving less detail but an easier-to-read listing is C. J. Roslund's program in *The Rainbow*, March, 1982, p. 31. Other programs have appeared that send the output of the DIR command to a printer. We wanted a program that would provide more information than the DIR command, yet would not use an entire printed page so that the user is forced to

TABLE 2. DISK STORAGE OF BASIC PROGRAM IN BINARY FORMAT

If the program of Table 1 is saved to disk, the sector containing the program will have the following bytes:

Byte No.	Byte	Comments	Byte No.	Byte	Comments
1	FF	Start marker	10	87	PRINT
2	00	Total length	11	20	
3	1F	of file	12	41	A
4	26	Address of	13	38	;
5	09	next line	14	FF	
6	00	Line #10	15	9B	SQR
7	0A		16	28	
8	89	INPUT	17	41	A
9	20		18	29	;
A	41	A	19	3A	:
B	00	End-line marker	1A	81	GO
C	26	Where another	1B	20	
D	1E	line could go	1C	A5	TO
E	00		1D	20	
F	14	Line #20	1E	31	I
			1F	30	O
			20	00	End-line marker

TABLE 3. DISK STORAGE OF BASIC PROGRAM IN ASCII FORMAT

The same example program, stored in ASCII format, would appear in its sector as follows:

Byte No.	Byte	Comments	Byte No.	Byte	Comments
1	0D	Start/end marker	15	20	Space
2	31	I	16	41	A
3	30	O	17	3B	;
4	20	Space	18	53	S
5	49	I	19	51	Q
6	4E	N	1A	52	R
7	50	P	1B	28	
8	55	U	1C	41	A
9	54	T	1D	29	
A	20	Space	1E	3A	:
B	41	A	1F	47	G
C	0D	Start/end marker	20	4F	O
D	32	2	21	20	Space
E	30	O	22	54	T
F	20	Space	23	4F	O
10	50	P	24	20	Space
11	52	R	25	31	I
12	49	I	26	30	O
13	4E	N	27	0D	Start/end marker
14	54	T			

TABLE 4. DISK STORAGE OF A MACHINE-LANGUAGE PROGRAM

As a sample program in machine-language, consider the following:

Hex Loc.	Machine Code	Mnemonic
6000	86 AA	LDA #\$AA
6002	B7 65 00	STA \$6500
6005	39	RTS

keep the summary separate from the disk. We extensively modified Roslund's program and came up with DISKLIST.

DISKLIST prints the file name/extension, notes whether the file is binary or ASCII, lists the number of granules used, and prints the start, end, and exec addresses for machine-language programs. Most important, it does this on a printout that is just the right size to fasten to the disk jacket. If the table contains more files than will fit on one side of the jacket, DISKLIST prints "continued on back" and finishes the listing with a new table that can be attached to the reverse side of the disk jacket.

The name/extension, file-type flag and ASCII flag, and the three addresses for machine-language files are saved in arrays; if you ever want to do anything

The command SAVEM "TEST BIN", &H6000, &H6005, &H6000 produces the following bytes in the sector used to hold this program:

Byte No.	Byte	Comments
1	00	"Begin" marker
2	00	Program is
3	06	6 bytes long
4	60	Start address
5	00	is \$6000
6	86	
7	AA	
8	B7	The
9	65	program
A	00	bytes
B	39	
C	FF	"End" marker
D	00	
E	00	
F	60	Execute address
10	00	is \$6000

else with the information, such as alphabetize the names for instance, just add the program code onto the end of our listing. We think you will agree that this is a very handy way to keep track of disk directories.

In Conclusion

We hope that this discussion of the makeup of BASIC and machine-language program files will give you the information you need to make better use of the disk system in your computing efforts. We also hope that the utilities will be useful, particularly in light of the high cost of many "Disk Doctor" and DISKZAP-type programs

that are available commercially. We haven't seen any of them, so we aren't in a position to compare their features with ours, but we feel that what we have done is worth at least the price of this magazine.

We were going to tell you how to beat that intermittent contact problem, weren't we? Unfortunately, there probably isn't any way to cure it permanently, short of soldering everything together, but we think we have found the next best thing. There are products sold for just this purpose: that is, keeping contact fingers clean on circuit boards in critical commercial equipment. We use Gold-Wipes®, made by the Texwipe Company, Upper Saddle River, NJ 07458. These are small, foil-sealed packets containing pads soaked in a solvent and contact-conditioning agent selling for about 25¢ apiece in boxes of 100. Friends or members of a computer club could go together and buy a box, but even if you have to shell out the whole \$25 yourself, it's well worth it. A treatment every month or so with these pads has cured our dirty-contact blues, and until Radio Shack wakes up and puts gold-plated connectors on their disk equipment, it should be a good fix for your system too.

You may contact the authors at Dept. of Chemical & Metallurgical Eng., U. of Alabama, P.O. Box 2662, University, AL 35486.

Listing 1

```

10 'DISKLOOKUTILITY
20 'BY MICHAEL DUDGEON AND BILL CLEMENTS
25 'COPYRIGHT © 1983 by MICRO Ink
30 CLEAR2000:DIM E(20)
40 CLS3:PRINT#3,"DISKLOOK";
50 PRINT#96,"ENTER GRANULE NO. IN HEX ";
:LINEINPUT$:IF G$<>"D" THEN 70
60 T=17:INPUT"SECTOR(1-18)":S:GOTO 90
70 G=VAL("8H"+$):IF G>33 THEN T=INT(G/2)+1
ELSE T=INT(G/2) TRACK NO.
80 S1=G/2-INT(G/2):IF S1=0 THEN INPUT"SECTOR(1-9)":S
ELSE INPUT"SECTOR(16-18)":S
90 S1=0:PRINT"TRACK" T" SECTOR" S:DSK1$ 0,T,S,A$(1),A$(2)
100 FOR Y=1 TO 2:IF T=17 AND S=2
THEN PRINT"BYTE NUMBERS-GRANULE NUMBERS"
110 IF T=17 THEN FOR X=0 TO 127 ELSE FOR X=1 TO 128
120 IF T=17 THEN P$=MID$(A$(Y),X+1,1)
ELSE P$=MID$(A$(Y),X,1)
130 PRINT USING"## ## ## ##";
HEX$(X),HEX$(ASC(P$)),P$
140 IF X=0 OR X/14<>INT(X/14) THEN 180
150 ' <@>: RETURN TO DISKLOOK
<D>: CREATE NEW DIRECTORY ENTRY
<C>: CHANGE BYTE IN FILE <F>: FILE ANALYSIS
160 A$=INKEY$:IF A$="I" THEN 160 ELSE IF A$="O" THEN 40
170 IF A$="D" THEN 200 ELSE IF A$="C" THEN 320
ELSE IF A$="F" THEN 350 ELSE IF A$="U" THEN X=X-28
180 NEXT X,Y:GOTO 40
190 ' CREATE NEW DIRECTORY LISTING
200 CLS2:PRINT"CREATE NEW DIRECTORY ENTRY"::
FOR S=3 TO 9:DSK1$ 0,17,S,A$,B$:C$=A$

```

```

+LEFT$(B$,127):FOR I=1 TO 225 STEP 32:
IF ASC(MID$(C$,I,1))<>0 AND ASC(MID$(C$,I,1))<>255 THEN NEXT I,S FIND FIRST UNUSED SLOT
210 IF I>128 THEN L9=2:I=I-128 ELSE L9=1
220 A$(1)=A$:A$(2)=B$
230 PRINT#96,"FILENAME.EXT":":LINEINPUTXX$:
XX=INSTR(XX$,"."):INSTR(XX$,"."):XY=
LEN(XX$):R$=RIGHT$(XX$,3):XX$=LEFT$(XX$,XY-4)
+STRING$(12-XY,")"+R$:IF R$="DAT"
THEN R2=255 ELSE R2=0
240 R3$=RIGHT$(XX$,3):IF R3$="BAS" THEN FT=0
ELSE IF R3$="DAT" THEN FT=1 ELSE IF
R3$="BIN" THEN FT=2
250 XX$=XX$+CHR$(FT)+CHR$(R2):X=1:
INPUT"SECTORS IN LAST GRANULE":DD
260 LINE INPUT"ENTER GRANULE NOS. IN HEX,
<@> AFTER LAST ONE. ";K$:E(X)=1+
VAL("8H"+K$):IF K$="0" THEN X=X-1 ELSE X=X+1:
GOTO 260' INPUT GRANULE NOS. IN ORDER
270 DSK1$ 0,17,2,A$,B$:FOR P=1 TO X-1:
MID$(A$,E(P),1)=CHR$(E(P+1)-1):NEXT P
280 MID$(A$,E(X),1)=CHR$(E(X)+DD):
DSK0$ 0,17,2,A$,B$: INSERT GRANULE NOS.
IN FILE ALLOCATION TABLE
290 XX$=XX$+CHR$(E(1)-1):INPUT"NUMBER OF BYTES
IN LAST SECTOR":Z:XX$=XX$+CHR$(0)
+CHR$(Z)+STRING$(16,0)
300 MID$(A$(L9),1,32)=XX$:DSK0$ 0,17,S,A$(1),A$(2):
SOUND 5,16:DSK2:GOTO 50
310 ' CHANGE BYTE
320 IF T=17 THEN E$=1 ELSE E$=0

```

(Continued)

the  *foxiest*

**WORDPROCESSOR
FOR THE COMMODORE 64™
ALSO CHECKS YOUR SPELLING!**

SCRIPT 64

Suggested Retail: \$139.95

"REALLY FOXY IS BEING LETTER PERFECT"

**Contact Your Nearest Commodore Dealer Today . . .
You'll Be So Glad You Did!**

Distributed By:

**COMPUTER
MARKETING SERVICES INC.**



300 W. Marlton Pike
Cherry Hill, New Jersey 08002
(609) 795-9480

Commodore 64 is a trademark of Commodore Electronics Limited
Script 64 is a trademark of Richvale Telecommunications

Circle No. 27

Listing 1 (continued)

```

330 CLS4:PRINT#8,"CHANGE ONE BYTE";:PRINT#96,
    "BYTE NO.(HEX) TO CHANGE";:INPUTB$:
    INPUT"NEW BYTE";NC$=MID$(A$(Y),VAL("H"+BB$)+E$0,1)
    =CHR$(VAL("H"+NC$)):DSKO$ 0,T,S,
    A$(1),A$(2):CLS2:GOTO 50
340 ' FILE ANALYSIS
350 CLS8:PRINT#41,"FILE ANALYSIS";:PRINT#96,
    "FILE NAME: ";:LINEINPUT$:IF LEN(F$)<8
    THEN F$=F$+STRING$(8-LEN(F$)," ")
360 PRINT#128,"EXTENSION: ";:LINEINPUT$:F$=F$+E$8
370 FOR X=3 TO 9:DSK1$ 0,17,X,A$,B$:
    IF INSTR(A$,F$) OR INSTR(B$,F$) THEN 380
    ELSE NEXT X:PRINT"ENTRY NOT FOUND":
    FOR X=17TO2000:NEXTX:GOTO350
380 X=INSTR(A$,F$):IF X=0 THEN X=INSTR(B$,F$):
    A$=B$ X=BYTE NO. FOR ENTRY LOCATED
390 A$=MID$(A$,X,32): A$ NOW=THAT SINGLE ENTRY REQUESTED
400 C=ASC(MID$(A$,12,1)):IF C=0
    THEN PRINT" BASIC" ELSE IF C=1 THEN PRINT"DATA"
    ELSE PRINT" MACHINE LANGUAGE"
410 IF ASC(MIO$(A$,13,1)) THEN PRINT" ASCII" ELSE PRINT" BINARY"
420 E(1)=ASC(MIO$(A$,14,1))
430 N=ASC(MIO$(A$,16,1))
440 DSK1$ 0,17,2,A$,B$:
450 X=1
460 E(X+1)=ASC(MID$(A$,E(X)+1,1)):
    IF E(X+1)>8HFF THEN SC=E(X+1)-8HCO
    ELSE E(X+1):GOTO 460
470 PRINT" GRANULES:":FOR P=1 TO X:PRINT"$"
    +HEX$(E(P)):NEXT P:PRINT" SECTORS IN LAST
    GRANULE:SC:PRINT" BYTES IN LAST SECTOR: "
    "$"+HEX$(N):PRINT:PRINT" HIT ANY KEY
    TO CONTINUE";
480 IF INKEY$<>"" THEN CLS3:GOTO40: ELSE 480

```

Listing 2

```

10 ' DIRDUPL UTILITY
20 ' OIRECTORY BACKUP AND RETRIEVAL
30 ' BY MICHAEL OUDGEON AND BILL CLEMENTS
35 ' COPYRIGHT @ 1983 by MICRO Ink
40 CLEAR3000:CLS3
50 PRINT#5,"OISK OIRECTORY BACKUP":
    PRINT#69,"(1) BACK UP DIRECTORY":
    PRINT#101,"(2) RETRIEVE OIRECTORY":
    PRINT#165,"WHICH":INPUTW
60 PRINT#229,"DRIVE NO.":INPUTON
70 ON W GOTO 90,140
80 GOTO50
90 FOR X=2 TO 8
100 OSKI$ ON,17,X,A$,B$:DSKO$ DN,17,X+10,A$,B$:
110 NEXT X
120 OSKI$ DN,17,9,A$,B$:DSKO$ ON,17,1,A$,B$:
130 END
140 FOR X=2 TO 8
150 DSK1$ DN,17,X+10,A$,B$:DSKO$ DN,17,X,A$,B$:
160 NEXT X
170 DSK1$ ON,17,1,A$,B$:DSKO$ DN,17,9,A$,B$:
180 END

```

Listing 3

```

10 'OISKLIST - DIRECTORY PRINTING UTILITY
20 ' BY BILL CLEMENTS
25 ' COPYRIGHT @ 1983 by MICRO Ink
30 CLS:CLEAR2000:C$=CHR$(13):
    PRINTTAB(6)" DIRECTORY PRINTER"C$:
40 OIMGR(67),N$(68),SA(68),EA(68),XA(68),T(68),F(68)
50 INPUT" DRIVE NO.":DN:PRINT" PRINTED OUTPUT (Y/N)":
    LINEINPUT"(DEFAULT IS 'N')":Q$:
    IF Q$="Y" THEN Q=-2 ELSE Q=0
60 L=0:L=25:LINEINPUT" DISK NAME? ";D$:IF Q=0 THEN CLS
70 PRINT#Q,TAB(10)*OISK: "$C$;GOSUB370
80 DSK1$ON,17,2,A$,B$:B$=LEFT$(A$,68):
    FORI=1TO68:GR(I-1)=ASC(MID$(B$,I,1)):NEXT
    'LINKED LIST OF FILE GRANULES
90 FORI=3TO11:DSK1$DN,17,I,X$,Y$:
    X$=X$+LEFT$(Y$,116) 'GET DIRECTORY ENTRIES
100 FORJ=1TO7:L=L+1:JJ=32*I:N$(L)=MID$(X$,JJ+1,8)
    +"."+MIO$(X$,JJ+9,3):G=ASC(MID$(X$,JJ+14,1)):
    FG=G 'NAME, EXTENSION, FIRST GRANULE
110 T(L)=ASC(MIO$(X$,JJ+12,1)):F(L)=
    ASC(MID$(X$,JJ+13,1)) 'FILE TYPE, ASCII FLAG
120 IFF(L)=0 THEN T$="BIN" ELSE T$="ASC"
130 B=ASC(LEFT$(N$(L),1)):IF B=0 THEN 200
    ELSE IF B=255 THEN 210 'SKIP IF KILLED OR UNUSED
140 FORK=1TO68:IF GR(G)<68 THEN G=GR(G):
    NEXTK 'SEARCH FOR LAST GRANULE
150 IF T(L)=2 THEN 230 'GO FIND ML ADDRESSES
160 IFL>LX THEN 350 'COUNT FILES
170 PRINT#Q,TAB(3)N$(L)TAB(17)T$TAB(20)K;
180 IF T(L)=2 THEN PRINT#Q,TAB(22)"$"+SA$+",$"+EA$+",$"+XA$;
190 PRINT#Q
200 NEXTJ,I
210 PRINT#Q,C$TAB(12)"FREE GRANULES:":FREE(DN)
220 STOP
230 LS=GR(G)AND31 'NO. SECTORS USED IN LAST GRANULE
240 LB=ASC(MIO$(X$,JJ+16,1)) 'BYTES IN LAST SECTOR
250 T=INT(FC/2)-(FG>=34) 'TRACK NO. OF FIRST GRANULE
260 S=1+9*(FG AND1) 'FIRST SECTOR FOR
    EVEN GRANULES =1, FOR ODO GRANULES=10
270 DSK1$ON,T,S,A$,B$ 'GET ML ADDRESSES
280 SA(L)=256*ASC(MID$(A$,4,1))+ASC(MID$(A$,5,1)):
    SA$=HEX$(SA(L)):SA$=STRING$(4-
    LEN(SA$),"0")+SA$ 'START ADDRESS
290 EA(L)=SA(L)+256*ASC(MIO$(A$,2,1))
    +ASC(MIO$(A$,3,1))-1:EA$=HEX$(EA(L)):EA$=STRING$(4-
    LEN(EA$),"0")-EA$ 'END ADDRESS
300 T=INT(G/2)-(G>=34) 'TRACK NO. OF LAST GRANULE
310 S=LS+9*(G AND1) 'LAST SECTOR NO.
320 DSK1$ON,T,S,A$,B$:A$=A$+LEFT$(B$,127)
330 XA(L)=256*ASC(MIO$(A$,LB-1,1))
    +ASC(MID$(A$,LB,1)):XA$=HEX$(XA(L)):XA$=STRING$(4-
    LEN(XA$),"0")+XA$ 'EXEC ADDRESS
340 GOTO160
350 PRINT#Q,C$TAB(9)"CONTINUED ON BACK"C$C$:
360 GOSUB370:LX=68:GOTO170
370 PRINT#Q,TAB(7)"NAME"TAB(15)"TYPE,GR.
    START,END,EXEC":PRINT#Q,TAB(7)STRING$(32,".")
380 RETURN

```

MICRO

A/D 12-Bit, 16 Channel \$450.00 AD - 121602

- Simple Software Selection of Channels
- Range $\pm 10, \pm 5, \pm 2.5, +5, +10$
- High-Speed 25μ Sec. Conversion
- Full Software Support — Disk or Prom
- Adjustable Bipolar Reference

Powerful — Economical — Professional

Peripherals for your Apple II*



Ultra Rom Board/Editor \$190.00 APB - 102

- Powerful G.P.L.E. [Global Program Line Editor] built in
- Includes: Search and Replace — Insert and Delete — and much more
- Edit programs 2 to 5 times faster
- 32K of Bank Switchable ROM Space
- Totally Transparent — Remove or Reload with a few keystrokes — without disk!
- Extensive Macro Table eliminates multiple keystrokes for common operations
- Useful Ampersand [&] Utilities all in one place
- Applesoft* Extensions including "IF, THEN, ELSE"
- Support for other HOLLYWOOD HARDWARE Products in Rom

Circle No. 28

6842 Valjean Avenue, Van Nuys, California 91406 (213) 989-1204

*Trademarks of Apple Computer Inc.

Products for Commodore, Atari, Apple, and others!

NEW

THE MONKEY WRENCH II A PROGRAMMERS AID FOR ATARI 800

NEW AND IMPROVED — 18 COMMANDS
PLUGS INTO RIGHT CARTRIDGE SLOT

If you are a person who likes to monkey around with the ATARI 800, then THE MONKEY WRENCH II is for you!! Make your programming tasks easier, less time-consuming and more fun. Why spend extra hours working on a BASIC program when the MONKEY WRENCH can do it for you in seconds. It can also make backup copies of boot type cassette programs. Plugs into the right slot and works with ATARI BASIC cartridge.

The MONKEY WRENCH provides 18 direct mode commands. They are: AUTO LINE NUMBERING — Provides new line numbers when entering BASIC program lines. RENUMBER — Renumerates BASIC's line numbers including internal references. DELETE LINE NUMBERS — Removes a range BASIC line numbers.

VARIABLES — Display all BASIC variables and their current value. Scrolling — Use the START & SELECT keys to display BASIC lines automatically. Scroll up or down BASIC program. FIND STRING — Find every occurrence of a string. XCHANGE STRING — Find every occurrence of a string and replace it with another string. MOVE LINES — Move lines from one part of program to another part of program. COPY LINES — Copy lines from one part of program to another part of program. FORMATTED LIST — Print BASIC program in special line format and automatic page numbering. DISK DIRECTORY — Display Disk Directory. CHANGE MARGINS — Provides the capability to easily change the screen margins. MEMORY TEST — Provides the capability to test RAM memory. CURSOR EXCHANGE — Allows usage of the cursor keys without holding down the CTRL key. UPPER CASE LOCK — Keeps the computer in the upper case character set. HEX CONVERSION — Converts a hexadecimal number to a decimal number. DECIMAL CONVERSION — Converts a decimal number to a hexadecimal number. MONITOR — Enter the machine language monitor.

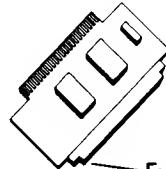
In addition to the BASIC commands, the Monkey Wrench also contains a machine language monitor with 16 commands used to interact with the powerful features of the 6502 microprocessor.



\$59.95

NEW

VIC RABBIT CARTRIDGE AND CBM 64 RABBIT CARTRIDGE



\$39.95
(includes Cartridge and Manual)

Expansion Connector on the VIC Cartridge

"High-Speed
Cassette
Load and Save!"

"Don't waste your life away waiting to LOAD and SAVE programs on Cassette Deck."

Load or Save 8K in approximately 30 seconds! Try it — your Un-Rabbitized VIC takes almost 3 minutes. It's not only fast but VERY RELIABLE.

Almost as fast as VIC Disk Drive! Don't be foolish — Why buy the disk when you can get the VIC Rabbit for much, much less!

Easy to install — it just plugs in.

Expansion Connector on rear.

Works with or without Expansion Memory.

Works with VIC Cassette Deck.

12 Commands provide other neat features.

Also Available for 2001, 4001, and 8032

Now for the "64"

STCP — 300/1200 Baud

Standard Terminal Communications Package

PFO IOD OOA CP<D1>D2 BELL = 12 30 00 10:14:36

Don't settle for non-standard Communications Protocol! Access Micro Net, Source, Bulletin Boards, Local Mainframe, etc.



- Complete Package — Includes RS232 Interface Board and software (does not include modem)
- Communicates in Industry Standard ASCII
- Upload/Download to/From Disk
- Automatic File Translation
- Can be controlled from keyboard or user supplied basic or machine language program

Specify 3.0 or 4.0 ROMS or 8032 Commodore Computer 4040 or 8050 or PEDISK II Disk or CBM64 on 1541.

Price: \$129.95

ATARI AND PET EPROM PROGRAMMER

Programs 2716 and 2532

EPROMs. Includes hardware

and software. PET = \$75.00 —

ATARI (includes sophisticated

machine language monitor) =

\$119.95



PET BASIC SCROLL PROGRAM

Scroll thru Basic Programs using cursor up/down keys. Specify computer. \$6.00 on cassette, \$9.00 on diskette.

65C02 MAE

Same as our MAE but enhanced for the new 65C02 Opcodes. Turns your computer into a development system for the new ROCKWELL 65C02 Microprocessor. \$200.00 — Specify Computer.

6800 CROSS ASSEMBLER

A Cross Assembler based on the MAE that runs on the PET, Apple, or Atari but assembles opcodes for the Motorola 6800 microprocessor. Turns your computer into a development system for the Motorola 6800 Microprocessor. \$200.00 — Specify Computer.

ATARI and VIC Cartridges

EHS can supply large quantities of ATARI and VIC Cartridges for software developers. If you need cartridges, call for pricing.



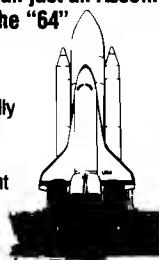
TRAP 65

TRAP 65 is a hardware device that plugs into your 6502's socket. Prevents execution of unimplemented opcodes and provides capability to extend the machine's instruction set. For PET/APPLE/SYM. Reduced from \$149.95 to \$89.95

More than just an Assembler/Editor!
Now for the "64"

MAE

for
PET
APPLE
ATARI
\$169.95
New
Price
\$99.95



Blast off with the software used on the space shuttle project!

- Designed to Improve Programmer Productivity.
- Similar syntax and commands — No need to relearn peculiar syntaxes and commands when you go from PET to APPLE to ATARI.
- Coresident Assembler/Editor — No need to load the Editor then the Assembler then the Editor, etc.
- Also includes Word Processor, Relocating Loader, and much more.
- Options: EPROM Programmer, unimplemented opcode circuitry.
- STILL NOT CONVINCED: Send for free spec sheet!

5 1/4 INCH SOFT SECTORED DISKETTES

Highest quality. We use them on our PETs, APPLES, ATARIs, and other computers. \$22.50/10 or \$44.50/20



EPROMS 2716 = \$4.50 2532 = \$7.50
Over 40 Commodore Programs by Baker (on 4040) = \$25.00

Programmer Printer - Excellent dot matrix print. Parallel = \$489.00

Serial = \$600.00 IEEE = \$589.00

DC Hayes Smart Modem = \$235.00
DC Hayes Micro Modem II = \$289.00

Rana Disk Drive - 375
4 Drive Controller - 114

EPROMS 2716 = \$4.50 2532 = \$7.50
Over 40 Commodore Programs by Baker (on 4040) = \$25.00

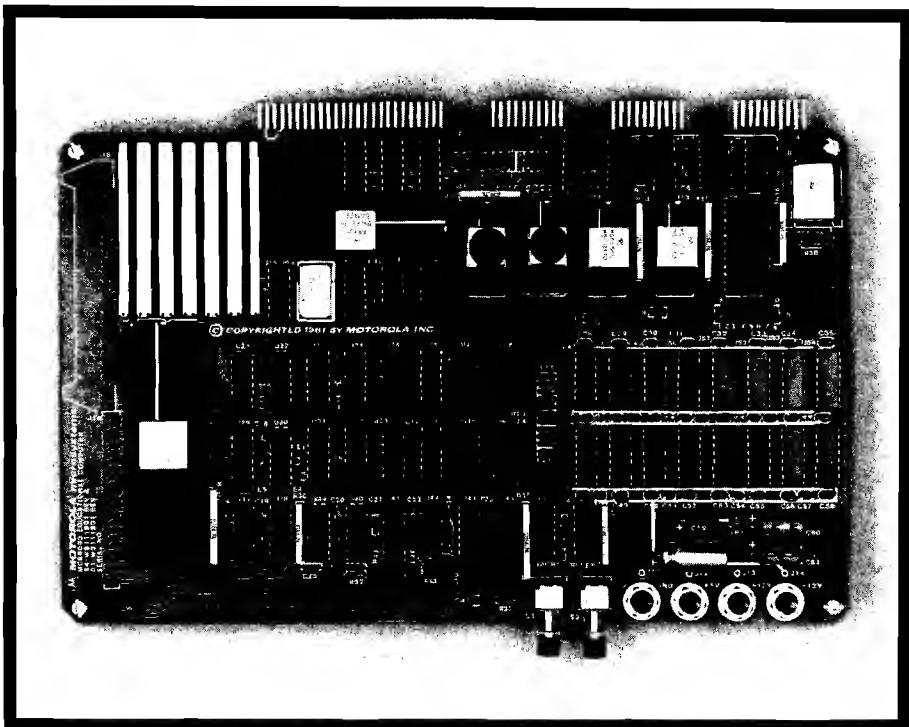
Eastern House

3239 Linda Dr.
Winston-Salem, N.C. 27106
(919) 924-2889 (919) 748-8446
Send for free catalog!



Circle No. 29

The 68000 Educational Computer Board



by Terry A. Jackson

One of the exciting items in the micro world these days is the Motorola 68000 16-bit microprocessor. A recent equipment item from Motorola, the MEX68KECB educational computer board, should also prove to be quite popular with those who want to learn how to use the 68000. Recently I purchased one of these boards to help upgrade my skills as a microprocessor instructor, and I am quite pleased with its capabilities. In this article I outline what I feel to be the board's important features so that you can judge whether or not it suits your needs.

Hardware Highlights

The board contains a 4MHz 68000 processor, 32K of user-programmable dynamic RAM, a 16K ROM monitor, two EIA RS-232C serial ports, a cassette tape recorder port, a parallel printer port, a 24-bit general-purpose programmable timer, and a very small

breadboard area (1 7/8" x 2 3/8"). You must provide a CRT terminal (or a teleprinter) and a power supply with +5-volt and \pm 12-volt outputs.

The 32K RAM memory removes a major limitation possessed by most of the popular "evaluation kits" and allows you to do some very ambitious programming. You can graduate from games to mini-interpreters, multi-tasking experiments, and other more sophisticated diversions. One of the RS-232C ports is assigned to the system terminal, and the other to a host system. The ports are separately jumper-adjustable to baud rates from 110 to 9600. The presence of a host is not required, since the system runs comfortably without it, but if such a luxury is available, the saving and reloading of programs is greatly enhanced. The cassette recorder port, operating at approximately 1300 baud, means economical mass storage for students with more limited resources.

The 7" x 10.5" - board is not a kit, it comes assembled and tested. Sockets

are used for the 68000, the 68230, the 4116 RAMs, the monitor ROMs, the 6850 serial interface chips, and the 14411 baud-rate generator. An envelope of push-on jumpers is provided for selection of various options, and even a set of insulated spacers and screws is included for mounting the board. Two pushbuttons are mounted on the board; one restarts and reinitializes TUTOR, the ROM-resident monitor, and the other simply aborts any user program, saves registers, and returns control to TUTOR. The abort function is particularly useful for debugging if a user program is in an infinite loop.

Those who want to experiment with hardware add-ons may find the breadboard area adequate, but two connectors can be attached easily for more ambitious expansion. All data lines, fifteen address lines, and most control signals are brought to a 46-pin connector pattern, and a 2 x 25 (0.1" spacing) uncommitted connector pattern allows access to the upper address bit decoder, other control signals, port

connections, or the breadboard area. The 68000 is designed to interface easily not only with its own family of peripherals, but also with the 6800 family.

I would like to pass along some helpful hardware-related hints. First, although the set-up instructions are generally quite detailed, there's a point I did not find mentioned. Your terminal must support the DTR (data terminal ready) line or your system will just stare back at you when you power up. Second, the markings on the lines to the terminal and to the host seem at first glance to be mixed up. Pin 3 on the host connector carries outgoing data and is marked TX DATA. Pin 3 on the system terminal connector carries incoming data and is also marked TX DATA. The reason for this is that the board is intended to look like a modem to the system terminal, and to look like a data terminal to the modem communicating with the host. With this perspective, everything looks normal. Third, many cassette tape recorders do not have the low side of the microphone input tied to the same point in the circuit as the low side of the output jack. If your recorder is one of these, check to see what the effect is of tying these two points together. On my machine, it simply changes the output level. If your recorder cannot tolerate having these two points tied together, you will have to connect one cable at a time, depending on whether you are dumping or loading. (This problem is not unique to the educational computer board. Every tape-oriented system I own or have encountered makes the same assumption, and I have witnessed resultant problems more than once.)

Software Features

A wide variety of keyboard commands is available using TUTOR. The most significant of these, the single-line assembler and the disassembler, deserve a detailed description. All valid 68000 operations can be entered in source form, one line at a time, from the keyboard. The object code is generated by TUTOR and stored sequentially in memory; however, the source lines are not saved. If you want to make changes, the memory-modify command with the disassembly option can be used to review and change selected instructions. The object code

and disassembled equivalent source are displayed, one line at a time, with the option of entering a different source line or simply advancing to the next instruction. At any time, a printer-attach command can be given and the memory-display command with the disassembly option can be used to produce a disassembled hard copy of the entire program. Finally, the object code can be dumped to the host or to cassette tape for future reloading.

The inability to save source is not as much of a problem as it might seem at first. If further revisions are to be made, a program may be reloaded and the revise-disassemble-dump cycle repeated. The disadvantages of a lack of source storage capability and the inability to use symbolic addressing do not appear to me to be serious for small programming exercises suited to learning the instruction set, but the support of a host system with an editor and assembler would be needed to effectively utilize the 32K of RAM. The equipment manual describes the object program storage format completely. This permits anyone with access to a full-blown assembler with an incompatible format to write a format conversion program. (This is typically a relatively easy job once the initial and target formats are known.)

One of the keyboard commands sets up a transparent mode in which a direct path exists between the system terminal and the host. This mode allows you to do the entire program development task, editing, assembly, and debugging from a single operating position. A user-selectable exit character will return control to TUTOR.

Several keyboard commands are available to support program debugging. Trace and breakpoint capabilities are included. In trace mode, a program may be stepped through, one instruction at a time. After each step, current register contents are displayed, and the next instruction to be executed is disassembled and displayed. Tracing may be set to run continuously without operator intervention, or to pause after each step and wait for a go-ahead from the operator. If the trace command is preceded by a printer-attach command, a hard copy of the action can be obtained for later review. Up to eight breakpoints can be set at any one time. Each breakpoint may have an optional

count entered as well. If a count, N, is entered, the program will halt just before the Nth execution of the designated instruction (and at each subsequent encounter), but not before. Breakpoints may be combined with continuous tracing if desired.

The only software flaw I have encountered is in the ASCII string handling for DC directives in the single-line assembler. If a blank is imbedded in the string, the assembler thinks you did not complete the line properly. This problem is avoided easily, and I understand will be fixed in a subsequent revision of TUTOR. The avoidance procedure consists of substituting the memory set command with its ASCII string option, and targeting the command to the same memory location that the disassembler was at when the problem was encountered.

The version of TUTOR that I have is 1.0; revision 1.1 is being shipped as of this writing, and revision 1.2 will be ready to go soon. Motorola sources indicated that enhancements as well as problem corrections can be expected in this newest version. It is apparent to me that they are supporting this product solidly as part of a program to capture a big chunk of the 16-bit market.

Conclusions

The educational computer board is an excellent choice for those who want to learn a lot about the 68000. It is a learning tool, not a computer to get data processing jobs done. Connected to a host with good language tools, the MEX68KECB's power is tremendously magnified.

The board requires no knowledge of hardware for its use, but permits hardware-oriented users to have some fun, too. No clever gimmicks interfere with almost unlimited hardware add-on projects.

Good software and thorough documentation, combined with a board that has lots of program room, make this an excellent buy at \$495.

Terry Jackson is a quality control engineer at Electro-Motive, a locomotive manufacturer in La Grange, IL. He is also an assistant professor at Midwest College of Engineering in Lombard, IL, teaching courses in microprocessor applications. You may contact him at 147 E. View St., Lombard, IL 60148.

MODEMS/CRTS/PRINTERS/SWITCHES/MICRO COMPUTERS/CABLES

MODEMS | PRINTERS | CRTS |

PRODUCT DESCRIPTION	LIST	YOUR COST	PRODUCT DESCRIPTION	LIST	YOUR COST
UDS 103LP, 300 bps, Modem	145	130	Incomm AB Switch, 8 Pin	120	84
UDS 202LP, 1200 bps, Half Duplex Modem	195	150	Incomm AB Switch, 25 Pin	159	98
UDS 212LP, 1200 bps, Full Duplex (212A) Modem	445	CALL	Incomm ABC Switch, 25 Pin	196	138
U.S. Robotics Auto Dial 212A, 300/1200 Full Duplex Modem	599	475	IDS Breakout Box (Blue Box)	159	140
Incomm Auto Dial 212A, 300/1200 Full Duplex Modem	599	450	Incomm Breakout Box (Bob)	150	120
Cermetec Auto Dial 212A, 300/1200 Full Duplex Modem	595	495			
Microband Auto Dial 212A, 300/1200 Full Duplex Modem	695	495			
Rixon Intelligent Modem, 300/1200 (10 Number)	495	CALL			
Rixon PC 212A (IBM PC Modem Card) 300/1200	495	CALL			
Incomm Multi Dial 300/1200 (10 Number)	795	550			
U.S. Robotics Password 300/1200 (Auto Dial) Modem	495	CALL			
U.S. Robotics Courier, Osborne, 300/1200 Modem	518	CALL			
U.S. Robotics S-100, 300/1200 Auto Dial Modem	495	CALL			
Visual 50 CRT	695	550			
Freedom 100 CRT, w/20 F, keys & Editing	595	550			
Incomm Remote Station I, w/Integrated 300/1200 Modem	1295	995			
Epson MX80/Grafix +	650	399	T-7MM, 7 Pin, 4 Wire, Telephone Cable (Modular Plugs)	10	7
Epson MX80 FT/Grafix +	700	498	S-975, Modular Double Adapter	7	5
Epson MX100/Grafix +	900	700	EIA 9/5, RS 232, 9 Pin Cable, 5 FT MM/MM	15	12
Epson FX-80	750	656	EIA 25/5, RS 232, 25 Pin Cable, 25 FT MM/MM	22	14
Star Micronics Gemini 10	399	350	EIA 50/5, Centronics Parallel Cable, 5 FT (36 Pin)	30	21
Star Micronics Gemini 15	649	548	MC 0050/10, Centronics 10 Ft. MM Cable, 36 Pin (10 FT)	38	25
AJ Letter Quality Printer, 30 CPS (KSR)	1450	1250	7010/5, IBM PC Printer Cable w/36 Pin	40	22
			8010/5 Apple II Printer Cable w/36 Pin	27	18
			9010/5, Atari Printer Cable w/36 Pin	30	21
			U.S. Robotics Telpac	79	CALL
			Rixon PC Com 1 (IBM PC Software)	69	CALL

SWITCHES | BOB

COMP. UTENS | CABLES

SOFT. WARE

ORDER TOLL FREE - 1-800-323-2666

TOUMAYAN & ASSOCIATES

115 N. Wolf Rd.
Wheeling, IL 60090

312-459-8866

We Welcome:

- Visa, Mastercharge
- Checks
- Company P.O.
- C.O.D. (Add. \$1.50/Shipment)

Circle No. 30

EVER WONDER HOW YOUR APPLE II WORKS?

QUICKTRACE will show you! And it can show you WHY when it doesn't!

This relocatable program traces and displays the actual machine operations, while it is running and without interfering with those operations. Look at these FEATURES:

Single-Step mode displays the last instruction, next instruction, registers, flags, stack contents, and six user-definable memory locations.

Trace mode gives a running display of the Single-Step information and can be made to stop upon encountering any of nine user-definable conditions.

Background mode permits tracing with no display until it is desired. Debugged routines run at near normal speed until one of the stopping conditions is met, which causes the program to return to Single-Step.

Price: \$50

QUICKTRACE was written by John Rogers. **QUICKTRACE** is a trademark of Anthro-Digital, Inc.

QUICKTRACE allows changes to the stack, registers, stopping conditions, addresses to be displayed, and output destinations for all this information. All this can be done in Single-Step mode while running.

Two optional display formats can show a sequence of operations at once. Usually, the information is given in four lines at the bottom of the screen.

QUICKTRACE is completely transparent to the program being traced. It will not interfere with the stack, program, or I/O.

QUICKTRACE is relocatable to any free part of memory. Its output can be sent to any slot or to the screen.

QUICKTRACE is completely compatible with programs using Applesoft and Integer BASICs, graphics, and DOS. (Time dependent DOS operations can be bypassed.) It will display the graphics on the screen while **QUICKTRACE** is alive.

QUICKTRACE is a beautiful way to show the incredibly complex sequence of operations that a computer goes through in executing a program.

QUICKTRACE requires 3548 (\$E00) bytes (14 pages) of memory and some knowledge of machine language programming. It will run on any Apple II or Apple II Plus computer and can be loaded from disk or tape. It is supplied on disk with DOS 3.3.

QUICKTRACE DEBUGGER

Last address		Disassembly	
Last Instruction	FF69- A9 AA	LDA	#\$AA
Top seven bytes of stack			
Stack	ST=7C A1 32 D5 43 D4 C1	NV-BDIZC	0000=4C
Accumulator	X reg.	Y reg.	Stack pointer
Contents	A=AA	X=98	Y=25
	SP=F2	FS=10110001	[]=DD
Disassembly		Reference address	
Next Instruction	FF6B- 85 33	STA	\$33 [\$0033]

Anthro-Digital, Inc.
P.O. Box 1385
Pittsfield, MA 01202
413-448-8278

COMPU \$ENSE

ATARI ADAPTOR

Play your 2600 games
on your VIC-20®

\$79.95

Frogger
Centipede
Strawberry
Shortcake

Space
Cavern
Shark Attack
Racquetball

Shipping & Handling Charges:

First two (2) items - \$2.00 per item.

Three (3) or more items - \$1.00 per item.

For orders over \$100 total, surface shipping will be paid by
CompuSense. Blue Label or special handling will be paid by
the customer.

Additional \$2.00 C.O.D. fee on all C.O.D. orders.

MasterCard and Visa accepted. Give card number and expiration
date on order form.

Allow three (3) weeks for personal checks.

TO ORDER:
P.O. Box 18765
Wichita, KS 67218
(316) 263-1095



Prices subject to change.

VIC-20® is a registered trademark of Commodore

**Write for
FREE
Catalog!**

VIC-20 or C-64

Circle No. 32

A UNIX-like OPERATING SYSTEM FOR 6809 MICROPROCESSORS

by STEPHEN L. CHILDRESS

Unless you've been on sabbatical to Siberia of late you will have noticed the swell of interest in the Unix™ operating system software. Most new and all the old popular 16-bit computers are supporting Unix or one of the numerous look-alikes. Why all the furor? It seems at last we've begun to rethink computer programming and usage. Recognizing that software development is expensive and time-consuming, we must exploit the falling cost of today's hardware. In this article, I explain how a new operating system software philosophy is being applied to small microcomputers capable of supporting a MC6809 processor. This software is called "OS-9" and is a good example of the rewards of rethinking system software.

This article is not so much to sing the praises of OS-9 as it is to point out the disappointing fact that most new computers being introduced today are a rehash of the disk operating systems of the 1970's (CP/M, PC-DOS, Apple DOS, etc.) There is a real catch-22 here exemplified by the IBM PC, which has a large memory space; it is running an improved but non-the-less CP/M derivative and therefore does not take advantage of the memory size to make the system more cost-effective. Another good example is Apple DOS, which, when outfitted with a new inexpensive hard disk, must resort to treating it in BASIC with some 72 independent floppy disks.

To date, the 6809 has not found the

success of the Z-80, et. al., not because it is inferior, but because it was introduced too near in time to the 16-bit chips. The 8086 and 8088 are used in systems that are not much better, faster, or cheaper than good Z-80 systems. But for the hundreds of thousands of byte-wide (8-bit) computers, OS-9 and the 6809 can be retrofitted to bolster the capabilities of existing systems. OS-9 is, at the time this is written, some two years mature and running on all of the "SS 50" computers, the Apple II, and several European computers. But lacking marketing giants like Tandy and IBM, the machines remain in the fringe areas and have a limited collection of off-the-shelf applications software. Rumor has it that Tandy is developing OS-9 for the Color Computer.

Time for Change

The Unix supporters favor a switch from yesterday's system software philosophies, which have evolved into stubborn, unwieldy enemies of the programmer and, consequently, the end-user. Bell Labs launched the Unix philosophy, the bottom line which might be described as: "Since software is increasingly expensive to develop, let's change the priorities from frugality in hardware and to abstraction in software design."

The Unix philosophy is reflected in the jargon: "Shell," "Kernal," "Filter," "Pipe," "Tee," and

"Socket" - each suggests a simple abstract idea about data processing. For example, Kernal and Shell simply refer to parts of the operating system that can be compared to layers. The concepts Filter, Pipe, and Tee deal with problems such as data base management more easily than the older "query, sort, merge, and report." General abstraction does cost more in terms of hardware, but in today's systems where hardware is a small part of a complete system price, the new priorities are encouraging.

OS-9 Evolution

While Unix was finding its way from DEC PDP-11/45's and 70's to other minicomputers, Motorola and Microware Systems Corporation teamed to produce software that would exploit the capabilities of the new MC6809 "pseudo 16-bit" microprocessor chip, which has all the memory addressing mode power of the minicomputers. The feature that distinguishes micros originally intended for use in industrial controllers from computers for general use is strength in addressing modes. The idea these two companies had was to develop an extremely modular set of reusable software. The benefits of modular software has been known for some time; but it has been realized only in limited terms, requiring the programmer to use monolithic compilers, assemblers, and linkers to effect a merger of modules. Although this works well, it is time consuming and far from ideal. Motorola wanted modularization to the extent of mass-produced "software-on-silicon" (ROMs). Before processors of the 6809's power, such an idea was impractical because of the lack of addressing power.

What is the ideal format for modularization? Here is a wish list, with the scientific name of the species in brackets:

1. Software modules that can be placed anywhere in memory without reassembly or link-loading — just copy it to memory verbatim from some media such as a disk. [Position-independence]
2. Modules that reside in EPROM or ROM already plugged into the address space of the machine. This would be good for modules that are used often. [ROM-able, Reentrant]

3. Modules that intercommunicate in a standard fashion without subtle sneak-paths that can get fouled up. Forbid fragile, spider-web arrangements of software interaction. [Stack-oriented]
4. The modules should contain "pure code" only and the variables used by a module should be in RAM supplied by the modules' parent (caller).
5. Allow programmer to "activate" modules coming from the software toolbox. These should have all the flexibility of old, stable modules. [Loadable]
6. For non-ROM modules (RAM), allow those not needed for the job at hand to be removed from memory, making more space for other modules.
7. Since requirements change and mistakes do happen, allow a new module to temporarily supersede an old one without hassle. [Precedence]
8. Allow modules to be shared among several users. [Reentrancy]
9. The system software should worry about which language is being used in a particular module — assembly, BASIC, etc..
10. The modules should be able to perform I/O without any knowledge of who/what/how regarding the I/O devices.
11. And last but not least, KISS! That's "Keep It Simple, Stupid."

Simple means small, and don't forget that modularization is supposed to mean that a non-Ph.D. can understand the overall system by concentrating on one piece at a time.

This is a tall order. What would the user's benefit be? The idea is to eliminate the aggravations caused by the older system philosophy. Consider this list of nuisances the computerist must face every day:

1. He needs to run Program B while in A, but A is incompatible with B because they both use the same memory region for their code.
2. A jury-rigged version of program B is made up to let B hide from A, say in high memory.
3. But A and B still fight over the same memory cells for variables. The hide and seek continues with some successes, some hokey fixes, and a few subtle disasters.
4. The programmer would like to swap A and B but he needs fast (expensive) disks.
5. Multiple users on a micro? There's not enough memory for two copies of the 20K-byte language program let alone the 8K or so for the programs.
6. The operating system doesn't support multiple terminals.
7. The operating system is too complex and will not allow changing I/O conditions without surgery, hacking, patching, and kludging.

8. A change to the I/O would require adjustments to almost all software. But much of it is copy-protected and cannot be modified.

9. Why should the user have to spend \$400 for a "print spooler" hardware box? Why can't the computer take 2% of its time to copy a disk file to the printer port without hassle?

These gripes go a long way back in time and remain today, even in improved operating systems like PC-DOS for the IBM. If you look, you'll see that the module wish list covers all of these headaches. Now let's look at what Motorola and Microware did to achieve these goals.

The OS-9 Big Picture

The OS-9 operating system is constructed from modules of machine code, each of which has:

- A string of ASCII characters that gives the module a name
- A module "header" that gives the module type, size, etc.
- Module's revision number
- Distance to the module's first instruction
- For program modules (as opposed to subroutines), the memory storage (RAM) required by the module
- A CRC module checksum to prevent bogus disk files (text) or improper ROMs from being treated as modules

Programs consist of one or more modules and may call subroutines or programs located in other modules. Compilers and interpreters (e.g., BASIC) are merely program modules. If a module is invoked by some program and that module is not in memory, OS-9 will automatically retrieve the module from disk. When no program needs use of a certain module, OS-9 removes it from memory and returns that memory to the pool of uncommitted memory. Though the users really need not be concerned with where modules are in memory, the "MDIR" utility shows a directory of in-memory modules as shown in figure 1.

The module directory shows each module's name, address in memory, size, attributes (program, subroutine, language, etc.), revision, and "use" count. The I/O drivers and the peripherals (device modules) are each handled by independent modules subordinate to modules RBF or SCF,

Figure 1 OS-9 Memory-Resident Module Directory

Module Directory at 21:28:13

Addr	Size	Typ	Rev	Attr	Use	Module	Name
F000	4D0	C1	1	r...	1	OS9p2	Kernel, part 2
F4D0	2E	C0	1	r...	1	Init	System Initialization module
F4FE	1BA	C1	1	r...	1	Boot	System Boot media fetcher
F800	7BF	C1	1	r...		OS9	Kernel, part 1
BA00	7F	C1	1	r...	1	SysGo	Starts up main user on "TERM"
BA7F	193	E1	1	r...	8	ACIA	Driver for RS232 serial devices
BC12	38	F1	1	r...	2	TERM	Device module for 1st CRT
BC4A	651	C1	1	r...	1	IMAN	Chief executive for all I/O
C29B	BBC	D1	1	r...	1	RBF	Chief of all File I/O, any device
CE57	41C	D1	1	r...	8	SCF	Chief of all Character I/O device
D273	33A	E1	1	r...		DC3	Device driver for mini-floppy
D5AD	2C	F1	1	r...		D0	Device module for minifloppy #0
D5D9	2F	F1	1	r...	1	H0	Device module for hard disk #0
D608	36	F1	1	r...	6	T1	Device module for 2nd CRT
D63E	216	E1	1	r...	1	WD1000	Device driver for hard disk
D854	CA	C1	1	r...	1	CLOCK	Device driver for 60Hz line clock
D91E	472	11	1	r...	2	Shell	Unix-like user interface (CLI)
DD90	2E	11	1	r...		Load	Utility to get module from disk
DBBE	48	11	1	r...		Unlink	Utility to remove module from mem.
AC00	1DA	11	1	r...	1	Mdir	Utility producing this report

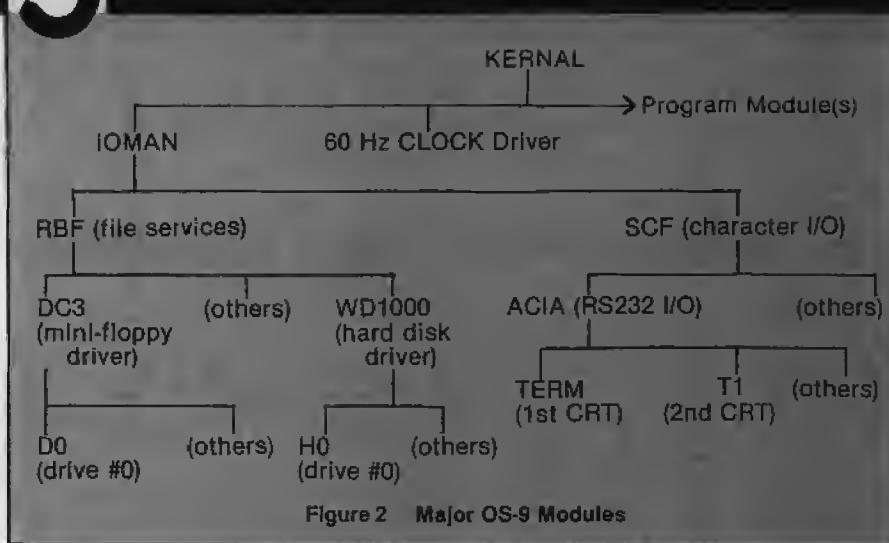


Figure 2 Major OS-9 Modules

which are, in turn, subordinate to IOMAN. In keeping with the module concept, device drivers and their device modules (e.g., WD1000 and H0) are loadable from disk. Thus, to add another disk drive, one merely prepares a new device module (a 5-minute job). To add a new type of peripheral, you merely write a new device driver (actually, paraphrase a similar old one), a one-day task. Note that these new modules do not affect the code within the existing modules in any manner whatsoever. Note also the small size of the peripheral drivers, which hints at their simplicity. Score one for the modular I/O goals in the wish list.

Now look at these modules from their kinship perspective rather than from the memory-map view (see figure 2). From this view these modules' functions are:

KERNAL — allocates and manages memory, time shares CPU among programs, coordinates inter-program signals, accepts and hands off jobs to appropriate I/O chiefs.

CLOCK — handles 60-per-second (power line) clock interrupts and keeps time of day and time-sharing slice intervals.

IOMAN — responsible for *all* requests for I/O, regardless of device. Interfaces programs in a uniform way to the various classes of I/O.

RBF — I/O control of random block-oriented devices such as disks. Takes care of directories, files, media allocation, etc. Calls upon various device drivers for physical I/O. Knows nothing about tracks or sectors; works with 32-bit "logical" block numbers.

SCF — I/O control of sequential character-oriented devices like CRTs,

which are, to the user programs, files that may be read or written exactly as RBF (disk) files (except for lack of random access). Knows nothing of the device characteristics, leaving that to a subordinate driver such as ACIA.

DC3 and WD1000 — Device drivers for specific hardware. Converts RBF's logical block number to track, sector, cylinder, or whatever is appropriate for the device. Talks to the device's I/O registers using either polled or interrupt-driven methods. Knows nothing of file structures. Declares that RBF manages I/O for the driver.

D0 — A device (descriptor) module for a mini-floppy. Supplies details of device; e.g., I/O register locations, number of tracks, sectors per track, drive number, seek time, double/single density/sided, etc. Contains data only, no code. D0 is the name programs use to refer to the peripheral for I/O activities on files on that device. This module states that its device is handled by the driver named DC3.

H0 — Identical to D0, except values unique to the hard disk. Defines WD1000 as the driver for device H0.

ACIA — Driver for RS-232 UART peripherals. Handles the characters from/to serial channels. Buffers incoming data for type-ahead. Buffers outgoing data to allow calling program to get on with concurrent work. Allows editing of typos, recall of last line entered, etc. Using device modules, it adapts to the terminal for upper/lower case, auto-line feed, nulls, etc. Declares that SCF manages the I/O for the driver.

TERM and T1 — Like D0 and H0, these device descriptor modules define the driver name for the TERM and T1 peripherals (CRTs) as ACIA, and the terminals' unique needs.

To perform I/O to a certain device, a program (in some language) says in effect: "READ from D0" or "WRITE to TERM" or whatever. If, for example, the desired device is H0 (the hard disk) the KERNAL catches the program's request and, since it is I/O, calls upon IOMAN. This module then looks for the device name (H0) in the module directory and finds the name of the driver (WD1000) within the H0 module. Within the WD1000 module is the name of the driver, RBF. Then IOMAN merely sends the programs I/O desires to the I/O chief, RBF, along with the addresses of the driver (WD1000) and device (H0) modules. From here, RBF takes care of the rest, with help from the driver WD1000.

Although it's not obvious, this maze-running has one simple advantage. The user's program requested I/O to some device H0, and OS-9 figured out that H0 with WD1000 and RBF could do the job. The beauty of the scheme is that the system handled the device I/O despite the fact that the device "H0" was unknown at the time the main system was written, assembled, and configured (and no "hacking and patching" was done). Indeed, WD1000 and H0 were merely loaded into memory just after booting from the floppy. The same is true for T1, the second CRT and, though not shown, for a printer attached as device "P", managed by ACIA and SCF. Clearly, more printers, say P1, or more CRTs, say T2, or more disks, say D1 or H1 or X8580 may be added without affecting the rest of the system in any way whatsoever. Remember, these modules are just small pieces of data or code loaded from some disk into memory whenever a peripheral is added. Indeed, the printer module P is loaded only when that printer is being used!

This concludes part 1. See the July issue of MICRO for part 2.

Steve Childress has been involved with mini and micro systems for over 15 years. He developed a discrete logic microcomputer using shift-register memory and an IBM output writer for I/O in the days of the \$300 8008 chip. Recently, he has contributed to the Apple II adaptation of the OS-9 system. You may contact him at 31220 La Baya Dr., Suite 110, Westlake Village, CA 91362.

MICRO

COM-STAR F/T

Tractor
Friction
Printer

only **\$299**

COM-STAR F/T

FREE

Box of printer paper and
demo tape with purchase.

- Lowest price quality tractor friction printer in the U.S.A. • Fast 80 characters per second
- 40, 46, 66, 80, 96, or 132 characters per line spacing • Prints labels, letters, graphs, and tables
- List your programs • Print out data from modem services

Deluxe
COMSTAR F/T
PRINTER — \$299.00

The Comstar is an excellent addition to any micro-computer system. (Interfaces are available for Apple, VIC-20, Commodore-64, Pet, Atari 400 and 800, and Hewlett Packard) At only \$299, the Comstar gives you print quality and features found only on printers costing twice as much. Compare these features.

- **Bi-DIRECTIONAL PRINTING** with a LOGIC SEEKING CARRIAGE CONTROL for higher through-put in actual text printing. 80 characters per second.
- **PRINTING VERSATILITY:** standard 96 ASCII character set plus block graphics and international scripts. An EPROM character generator includes up to 224 characters.
- **INTERFACE FLEXIBILITY:** Centronics is standard. Options include EIA RS232C, 20mA Current Loop. (Add \$20.00 for RS232)
- **LONG LIFE PRINT HEAD:** 100 million character life expectancy.
- **THREE SELECTABLE CHARACTER PITCHES:** • 10, 12 or 16.5 characters per inch. 132 columns maximum. Double-width font also is standard for each character pitch.
- **THREE SELECTABLE LINE SPACINGS:** 6, 8 or 12 lines per inch.
- **PROGRAMMABLE LINE FEED:** programmable length from 1/144 to 255/144 inches.

• **VERTICAL FORMAT CONTROL:** programmable form length up to 127 lines, useful for short or over-sized preprinted forms.

• **FRICITION AND TRACTOR FEED:** will accept single sheet paper.

• **224 TOTAL CHARACTERS**

• **USES STANDARD SIZE PAPER**

If you want more try —

Premium Quality
COMSTAR F/T SUPER-10"
PRINTER — \$389.00

More Features Than MX-80
For \$250 Less

For \$389.00 you get all of the features of the Comstar plus 10" carriage, 100 cps, 9 x 9 dot matrix with double strike capability for 18 x 18 dot matrix. High resolution bit image (120 x 144 dot matrix), underlining, backspacing, 2.3K buffer, left and right margin settings, true lower descenders, with super and subscripts, and prints standard, Italic, Block Graphics, special characters, plus 2K of user definable characters. For the ultimate in price performance the Comstar F/T Super 10" leads the pack!

80 COLUMN PRINTER \$199

Super silent operation, 60 CPS, prints Hi-resolution graphics and block graphics, expanded character set, exceptionally clear characters, fantastic print quality, uses inexpensive thermal roll paper!

Double
Immediate Replacement
Warranty

We have doubled the normal 90 day warranty to 180 days. Therefore if your printer fails within "180 days" from the date of purchase you simply send your printer to us via United Parcel Service, prepaid. We will IMMEDIATELY send you a replacement printer at no charge via United Parcel Service, prepaid. This warranty, once again, proves that WE LOVE OUR CUSTOMERS!

15 DAY FREE TRIAL

OTHER OPTIONS

Extra Ribbons	\$ 5.95
Roll Paper Holder	32.95
Roll Paper	4.95
5000 Labels	19.95
1100 Sheets Fan Fold Paper	13.95

Add \$20.00 shipping, handling and insurance. Illinois residents please add 6% tax. Add \$40.00 for CANADA, PUERTO RICO, HAWAII, ALASKA orders. WE DO NOT EXPORT TO OTHER COUNTRIES. Enclose cashiers check, money order or personal check. Allow 14 days for delivery, 2 to 7 days for phone orders, 1 day express mail available!! Canada orders must be in U.S. dollars.

PROTECTO
ENTERPRISES (FACTORY-DIRECT)

BOX 550, BARRINGTON, ILLINOIS 60010
Phone 312/382-5244 to order

COMSTAR F/T

ABCDEFGHIJKLMNPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890
1 mn opqrstuvwxyz 1234567890
ABCDEFGHIJKLMNPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

SUPER-10"

ABCDEFGHIJKLMNPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz 1234567890

Operating System Commands

Color Computer DOS

Disk Operating Commands :

Disk directory index
File copy
Disk copy
Assign I/O buffers

Delete disk file
Execute binary file
Load file into memory
Merge file into memory file
Take input from disk file

Output disk file in ASCII

Format disk
Rename disk file
Close open files
Save memory to disk file

Error-check on disk writes
Select default drive

DIR <dn>
COPY <file spec1> TO <file spec2>
BACKUP <dl> [TO <d2>]
OPEN "<node>",<buff>,<file spec>,<recalen>
KILL "<file spec>"
EXEC (File must be in memory)
LOADM "<file spec>",<offsetadr>
MERGE "<file spec>",<R>
DSK1\$ <dn>,<trk>,<sec>,<str1>,<str2>
DSKO\$ <dn>,<trk>,<sec>,<str1>,<str2>
DSKINI <dn>
RENAME "<file spec1>" TO "<file spec2>"
UNLOAD [dn]
SAVEM "<file spec>",<strtadr>,<endadr>,<execadr>
VERIFY [ON or OFF]
DRIVE <dn>

BASIC Commands :

Open new sequential file
Open old sequential file
Open random array file
Close file channel(s)
Delete disk file
Rename disk file
Display free space on disk
Write to sequential file
Read from sequential file
Write to random record file
Read from random record file
Save a program on disk
Load a program from disk
Execute a BASIC program
from disk

OPEN "I",<buff>,<file spec>,<recalen>
Same
OPEN "D",<buff>,<file spec>,<recalen>
CLOSE #<buff>[, <buff# list>]
KILL "<file spec>"
RENAME "<file spec1>" TO "<file spec2>"
PRINT FREE(<dn>)
PRINT #<buff>,<data>
WRITE #<buff>,<data>
INPUT #<buff>,<data>
LINE INPUT #<buff>,<data>
PUT #<buff>[, <recno>]
GET #<buff>[, <recno>]
SAVE "<file spec>",<A>
LOAD "<file spec>"
RUN "<file spec>",<R>
LOAD "<file spec>,<R>
MERGE "<file spec>,<R>"

OS-65D

Disk Operating Commands :

Disk sector directory
List disk directory
Create new file
Delete disk file
Rename disk file
Copy disk or disk files
Copy data files
Compare disks or files
Sort records in a disk file
Pack files to front of disk
Fill a file with nulls
File copy
Assign I/O buffers
Load file
Execute binary file
Execute binary file in
BASIC workspace
Load file into memory
Load track into memory
Take input from disk file
Format disk
Format single track
Send output to disk file
Save memory to disk file

DIR <tt> (tt=00-76)
RUN "DIR"
RUN "CREATE"
RUN "DELETE"
RUN "RENAME"
RUN "COPIER"
RUN "DATRAN"
RUN "COMPAR"
RUN "GOSORT"
RUN "REPACK"
RUN "ZERO"
LOAD <file spec1>,<PUT> <file spec2>
RUN "CHANGE"
LOAD <file spec>
CA <adr>=<trk>,<sec>,<G0> <adr>
XQT <file spec>

CA <adr>=<trk>,<sec>
EXAM <adr>=<tt>
INPUT #<6 or 7>
INIT
INIT <tt>
PRINT #<6 or 7>
SA <trk>,<sec>=>adr>/<sec>=<adr>/<pages>

BASIC Commands :

Open new sequential file
Open old sequential file
Open random array file
Close file channel
Append disk files
Write to sequential file
Read from sequential file
Find string in sequential file
Write to random record file
Read from random record file
Save a program on disk
Load a program from disk
Send control to new program
Execute a BASIC program
from disk

DISK OPEN,<dev>,<file spec>
Same
DISK OPEN,6,<file spec>
DISK CLOSE <6 or 7>
DISK! "LO <file spec1>," LIST[,]
DISK! "LO <file spec2>," CTRL-X
PRINT #<dev>,<data>
INPUT #<dev>,<var>
FIND "<string>"
DISK GET <rec>,<PRINT #6,<var>>
DISK GET <rec>,<INPUT #6,<var>>
DISK! "PUT <file spec>"
DISK! "LOAD <file spec>"
RUN "<file spec>"
RUN "<file spec>"

APPLE DOS

Disk Operating Commands :

Disk directory index
File copy
Disk copy
Assign I/O buffers
Delete disk file
Execute disk-input command
Execute binary file
Load file into memory
Format disk
Protect disk files
Unprotect disk files
Rename disk file
Save memory to disk file

Error-check on disk writes
Monitor I/O channel
Turn off Monitor
Direct output to I/O channel PR#<x>
Direct input to I/O channel IN#<x>

CATALOG
BRUN FID
RUN COPYA
MAXFILES <x> (default 3)
DELETE <file spec>
EXEC <file spec>
BRUN <file spec>,[A[\$]<adr>]
BLOAD <file spec>,[A[\$]<adr>]
INIT <file spec>
LOCK <file spec>
UNLOCK <file spec>
RENAME <file spec>
BSAVE <file spec>,A[\$]<adr>,L[\$]<len>
VERIFY <file spec>
MON [C,I,O]
NOMON [C,I,O]

Open random record file
Close file channel
Send control to new program
Send control to new program
saving variables
Delete disk file
Rename disk file
Write to sequential file
Write to the end of
sequential file
Read from sequential file
Read from a specific point
in a sequential file
Write to random record file
Read from random record file
Save a program on disk
Load a program from disk
Execute a BASIC program
from disk

PRINT CHR\$(4)"OPEN <file spec>,L<len>"
PRINT CHR\$(4)"CLOSE [<file spec>]"
PRINT CHR\$(4)"RUN <file spec> "
PRINT CHR\$(4)"BLOAD CHAIN,A520"
CALL 520"<file spec>"
PRINT CHR\$(4)"DELETE <file spec>"
PRINT CHR\$(4)"RENAME <file spec1>,<file spec 2>"
PRINT CHR\$(4)"WRITE <file spec>"
PRINT <data>
PRINT CHR\$(4)"APPEND <file spec>"
PRINT <data>
PRINT CHR\$(4)"READ <file spec>"
INPUT [or GET] <data>
PRINT CHR\$(4)"POSITION <file spec>,R<x>"
PRINT CHR\$(4)"WRITE <file spec>,R<x>"
PRINT <data>
PRINT CHR\$(4)"READ <file spec>,R<x>"
INPUT [or GET] <data>
SAVE <file spec>
LOAD <file spec>
RUN <file spec>

BASIC Commands :

Open new sequential file
Open old sequential file

Operating System Commands

6809 FLEX

Operating System Commands Data Sheet #16

Disk Operating Commands :

Assign system & work drives ASN [,W=<drv>][,S=<drv>]
 Append disk files APPEND <file spec>[,<file list>],<file spec>
 Create new text file BUILD <file spec>
 Disk directory index CAT [<drv list>][,<match list>]
 File copy COPY <file spec>,<file spec>
 Delete disk file COPY <file spec>,<drv>
 Execute disk-input command COPY <drv>[,<drv>][,<match list>]
 Execute binary file DELETE <file spec>[,<file list>]
 Load file into memory EXEC <file spec>
 Take input from disk file <file spec>[.CMD] (default)
 Output disk file GET <file spec>[,<file list>]
 Format disk I,<file spec>,<command>
 Send output to disk file LIST <file spec>[,<line range>]
 Protect disk files [,+N(or P)]
 Rename disk file NEWDISK <drv>
 Save memory to disk file O,<file spec>,<command>
 Error-check on disk writes PROT <file spec>[,,(opts)]
 Check disk file version RENAME <file spec1>,<file spec2>
 Direct output to printer SAVE <file spec>,<begadr>,<endadr>[,<transadr>]
 Install new boot program VERIFY [,ON (or OFF)]
 VERSION <file spec>
 P,<command>
 LINK <file spec>

BASIC Commands :

Open new sequential file OPEN NEW "<file spec>" AS <I/O Channel>
 Open old sequential file OPEN OLD "<file spec>" AS <I/O Channel>
 Open random array file OPEN [NEW or OLD] "<file spec>" AS <I/O Channel> DIM #<I/O Channel>,v[\$]
 Open random record file (<x>)[=<length>]
 Close file channel OPEN "<file spec>" AS <I/O Channel>
 Send control to new program FIELD #<I/O channel>,<len> AS <v\$>[,<filelist>]
 Delete disk file CLOSE <I/O channel>
 Rename disk file CHAIN "<file spec> 'x'(default)
 Write to sequential file KILL "<file spec>"
 Read from sequential file RENAME "<file spec1>,"<file spec2>"
 Write to random record file PRINT #<I/O channel>[,USING <v\$>],<data>
 Read from random record file INPUT #<I/O channel>[,USING <v\$>],<data>
 Save a program on disk PUT #<I/O channel>[,RECORD <x>]
 Load a program from disk GET #<I/O channel>[,RECORD <x>]
 Execute a BASIC program SAVE "<file spec> [.BAS]" (default)
 from disk LOAD "<file spec> [.BAS]" (default)
 Compile a Basic program RUN "<file spec> [.BAC]" (default)
 COMPILE "<file spec> [.BAC]" (default)

OS-9

Disk Operating Commands :

Append disk files MERGE <path>[<path>]
 Create new text file BUILD <path>
 Create a new directory MDIR <path>
 Disk directory index DIR [e][<path>]
 Module directory index MDIR [e]
 Change working data dir CHD <pathlist>
 Change working exec dir CHX <pathlist>
 File copy COPY <path><path>
 Delete disk file DELETE <path>[<path>]
 Execute binary file EX <modname>[<modifiers>]
 Load file into memory [<parameters>]
 Output disk file in ASCII LOAD <path>
 Output disk file in Hex LIST <path>[<path>]
 Format disk DUMP <path>[<path>]
 Protect disk files FORMAT <devname>[<opts>]
 Unprotect disk files ATTR <path>[<opts>]
 Rename disk file Same
 Save memory to disk file RENAME <path><newname>
 Error-check on disk writes SAVE <modname>[<modname>]
 Install current boot program VERIFY [U]
 Install new boot program COBBLER /<devname>
 Echo input to output path OS9GEN /<devname>
 Free space remaining ECHO <text>
 Log user onto system FREE <devname>
 Abort process LOGIN
 Display procedures & status KILL <procID>
 Set process priorities PROCS [e]
 Display memory free SETPR <procID><number>
 MFREE [e]

Free memory module
 Print errors in English
 Time share monitor

UNLINK <modname>[<modname>]
 PRINTERR
 TSMON [<pathlist>]

BASIC Commands :

Open new file CREATE #<I/O Channel>,<name>[:<access mode>]
 Open old sequential file OPEN #<I/O Channel>,<name>[:<access mode>]
 Close file channel CLOSE #<I/O Channel>[,<I/O Channel>]
 Send control to new program CHAIN <filename>
 Delete disk file DELETE <filename>
 Rename disk file RENAME <procname>,<newprocname>
 Write to sequential file WRITE #<I/O Channel>,<data>
 Read from sequential file READ #<I/O Channel>,<data>
 Read from a specific point SEEK #<I/O Channel>,<expr>
 in a sequential file Write to random record file SEEK #<I/O Channel>,<expr>
 Write to random record file PUT #<I/O Channel>,<data struc>
 Read from random record file SEEK #<I/O Channel>,<expr>
 Save a program on disk GET #<I/O Channel>,<data struc>
 Load a program from disk SAVE [<procname>][,<procname>]
 Execute a BASIC program LOAD <pathlist>
 from disk RUN [<procname>][<erpr>][,<expr>]
 Compile a BASIC program PACK [<procname>][,<procname>]

ORCA/M

Disk Operating Commands :

Append disk files APPEND <file spec>
 Create new text file NEW
 Edit old file EDIT
 Disk directory index CATALOG
 Disk sector read PEEK
 File copy COPY
 Delete disk file DELETE <file spec>
 Execute binary file BRUN <file spec>
 Load file into memory LOAD <file spec>
 Protect disk files LOCK <file spec>
 Unprotect disk files UNLOCK <file spec>
 Rename disk file RENAME <file spec1>,<file spec2>
 Save memory to disk file SAVE [<file spec>]
 Select disk drive any command [,S<s>],D<d>]
 Select default drive (default)
 Select volume any command [,V<v>]
 Free space remaining (default on CATALOG)
 Abort process ESCape

Display memory free FREE
 Check disk file version EXPAND
 Reset version number RESET
 Print file in memory PRINT
 Set printer left margin MARGIN <x>
 Boot new disk DOS [<s>]
 Compile file COMPILE [<opts>]
 Assemble file ASSEMBLE [<opts>]
 Disk bad sector check CHECK
 Alphabetize catalog COMPRESS A
 Compress catalog COMPRESS C
 Set disk volume number VOLUME <v>
 Restore deleted file RESTORE <file spec>
 Assemble, Link and Execute RUN <file spec>
 Change catalog order SWITCH <file spec1>,<file spec2>
 Set tab stops TAB
 Print current time TIME

Calibration by

Least Squares

Polynomials

on the Atari

by Mike Dougherty

Homebrew computer sensors are often plagued by calibration problems. The following program allows a set of calibration data points to be fitted with a least squares polynomial, allowing for efficient and compact interpolation of data.

A common problem encountered while building remote sensors for the personal computer is the calibration of these homebrew sensors. In a few cases, the calibration can be computed by a mathematical analysis of the hardware, often tedious and difficult. An easier approach is to take a set of calibration data points and fit a "best" curve through this data. Usually the functional form of the curve is known *a priori* from the hardware being used and only the parameters of the curve need be determined. LSQPOLY is an Atari 800 BASIC program designed to take a set of calibration data points, perform a polynomial least squares regression upon the calibration data, and visually plot the results. The output of LSQPOLY consists of a set of polynomial coefficients, $COEF_1$, $COEF_2$, ... $COEF_{m+1}$ where m is the highest degree of the polynomial. A point, V , within the range of the interpolation is computed by the polynomial evaluation:

$$F(V) = COEF_1 + COEF_2 \times V +$$

$$COEF_3 \times V^2 + \dots + COEF_{m+1} V^m$$

or

$$F(V) = \sum_{i=1}^{m+1} COEF_i \times V^{i-1}$$

The numerical methods used in LSQPOLY have been adapted from *Numerical Methods with Fortran Case Studies* by W.S. Dorn and D.D. McCracken and may be found in most texts on numerical analysis. While the methods used may fit a polynomial of any degree to the calibration data, I chose to limit LSQPOLY to polynomials of the fifth degree or less. From my experience with polynomial approximation, the higher order polynomials fit the calibration data better by "wiggling," instead of finding a

```

1000 REM ----- LSQPOLY -----
1001 REM
1002 REM . by Mike Dougherty
1003 REM
1004 REM
1005 REM FIT A LEAST SQUARE POLYNOMIAL
1006 REM UP TO ORDER 5 THROUGH A SET
1007 REM OF CALIBRATION DATA POINTS.
1008 REM ALLOW THE USER TO GRAPHICALLY
1009 REM JUDGE THE RESULTING LSQ FIT.
1010 REM
1011 REM -----
1012 REM
1013 REM
1050 DIM X(50),Y(50),OPTION$(1),PAUSE$(1)
1060 DIM SUM(10),RIGHT(6),MATRIX(6,7)
1070 DIM COEF(6),YFIT(159)
1090 REM
1091 REM
1092 REM -----
1093 REM
1094 REM -- PRESENT THE LSQPOLY USER
1095 REM -- OPTIONS VIA MENU FORMAT.
1096 REM
1097 REM -----
1098 REM
1099 REM
1100 FOR FOREVER=0 TO 1 STEP 0
1110 GRAPHICS 0
1120 POSITION 3,5:PRINT "Select Option"
1130 POSITION 5,7:PRINT "D - Enter calibration Data"
1140 POSITION 5,8:PRINT "S - Show calibration data"
1150 POSITION 5,9:PRINT "R - Regression up to order 5"
1160 POSITION 5,10:PRINT "C - Print Coefficients"
1170 POSITION 5,11:PRINT "I - Interpolate Y values"
1180 POSITION 5,12:PRINT "G - Generate polynomial plot data"
1190 POSITION 5,13:PRINT "P - Plot polynomial data"
1200 POSITION 18,5
1210 INPUT OPTION$
1310 IF OPTION$="D" THEN GOSUB 2000
1320 IF OPTION$="S" THEN GOSUB 3000
1330 IF OPTION$="R" THEN GOSUB 4000
1340 IF OPTION$="C" THEN GOSUB 5000
1350 IF OPTION$="P" THEN GOSUB 6000
1360 IF OPTION$="I" THEN GOSUB 7000
1370 IF OPTION$="G" THEN GOSUB 8000
1390 NEXT FOREVER
1500 REM
1501 REM
1502 REM -----
1503 REM
1504 REM EACH OPTION IS HANDLED AS A
1505 REM SEPARATE SUBROUTINE, EACH
1506 REM STARTING ON AN EVEN THOUSAND
1507 REM LINE NUMBER.
1508 REM
1509 REM -----
1510 REM
1511 REM
1512 REM
2000 REM
2001 REM -- ENTER THE CALIBRATION DATA.
2002 REM
2110 GRAPHICS 0
2120 PRINT "Number of data points ";
2130 INPUT N
2210 FOR NUMBER=1 TO N
2220 PRINT "X(";NUMBER;") ";:INPUT VALUE:X(NUMBER)=VALUE
2230 PRINT "Y(";NUMBER;") ";:INPUT VALUE:Y(NUMBER)=VALUE
2240 PRINT
2250 NEXT NUMBER
2260 RETURN
3000 REM
3001 REM -- SHOW THE CALIBRATION DATA
3002 REM -- FOR VERIFICATION.
3003 REM
3100 GRAPHICS 0:POKE 752,1

```

(continued)

single smooth curve. As a rule of thumb, I choose the lowest order polynomial that gives a uniformly smooth curve reasonably close to the calibration data.

Instead of computing a numerical measure of error, LSQPOLY allows the user to visually compare the raw calibration data to data generated from the polynomial. In my opinion, this visual comparison allows a more meaningful evaluation of the least squares fit. The object is not to see how close the curve can be bent to pass near each calibration datum, but rather to pick a smooth "best" curve which will represent the functional relationship of the physical quantity being measured.

As a word of caution, LSQPOLY should be used to interpolate only within the range of the calibration data — do not try to extrapolate outside of the calibration data range. When using high order polynomials, a smooth monotonic curve within the limits of the calibration data can rapidly change direction outside of that range. In practice, the calibration data should include points at the extremes of the sensor range to properly "nail down" the curve.

Numerical Methods

A full discussion of polynomial regression may be found in the Dorn and McCracken text previously cited. As a summary, minimizing the sum of the square of the Y deviation yields the following matrix equation for a fit of n data points by a polynomial of order m :

$$[\text{MATRIX}] \times [\text{COEF}] = [\text{RIGHT}]$$

where

$$\text{MATRIX}_{ij} = \begin{cases} n & \text{for } i=j=1 \\ \sum_{k=1}^n X_k^{i+j-2} & \end{cases}$$

$$\text{RIGHT } i = \sum_{k=1}^n X_k^{i-1} \times Y_k$$

Note: LSQPOLY uses the FORTRAN convention of beginning subscripts with 1.

LSQPOLY solves the above matrix equation for the coefficients, COEF, by Gaussian Elimination.

The resulting coefficients, $COEF_1, \dots, COEF_{m+1}$ are used to interpolate the functional value of any point within the calibration data range. The

polynomial total of a specific abscissa value is:

$$\text{TOTAL} = \sum_{i=1}^{m+1} \text{COEF}_i \times \text{VALUE}^{i-1}$$

This may be evaluated in BASIC by the following methods:

```
TOTAL = COEF(1)
FOR I=2 TO M+1
TOTAL = TOTAL + COEF(I) ×
(VALUE ↑(I-1))
NEXT I
```

— or —

```
TOTAL = 0
FOR I = M+1 TO 1 STEP -1
TOTAL = TOTAL × VALUE +
COEF[I]
NEXT I
```

The second method, requiring no exponentiation, is Horner's method of polynomial evaluation. This method is particularly suited to small computer use.

As a rule, polynomial regression should be applied to the variable without error. That is, if X_i is an error free value, but Y_i contains error due to measurement, then the regression should express Y in terms of X :

$$Y = \text{COEF}_1 + \text{COEF}_2 \times X + \dots + \text{COEF}_{m+1} \times X^m$$

This regression allows for the interpolated value of Y to be computed, given any value of X . However, for $M > 1$, the interpolated value of X cannot be easily computed, given a value of Y . In this case, the polynomial regression must be applied on the Y values, even though they contain measurement errors:

$$X = \text{COEF}_1 + \text{COEF}_2 \times Y + \dots + \text{COEF}_{m+1} \times Y^m$$

If the visual fit is reasonable then the regression should pose no serious problem.

Finally, note that the matrix formed by this method may be quite ill-conditioned and subject to severe numerical errors. Such errors are easily detected by the visual comparison of the fit data and the calibration data. Thus far, no numerical difficulties have been encountered through ordinary use of LSQPOLY.

```

3110 FOR NUMBER=1 TO N
3120 PRINT " X(";NUMBER;")": ";X(NUMBER),
3122 PRINT "Y(";NUMBER;")": ";Y(NUMBER)
3130 NEXT NUMBER
3140 PRINT :PRINT "Press RETURN to continue";
3150 INPUT PAUSE$
3160 RETURN
4000 REM
4001 REM -- PERFORM THE LSQ POLYNOMIAL
4002 REM -- REGRESSION ON THE DATA.
4003 REM
4004 REM -- REFER TO "NUMERICAL METHODS"
4005 REM -- WITH FORTRAN CASE STUDIES"
4006 REM -- BY DORN & McCracken
4007 REM
4110 GRAPHICS 0
4120 PRINT "Order of regression ";
4130 INPUT ORDER:IF ORDER>5 THEN RETURN
4150 FOR I=1 TO 2*ORDER
4160 SUM(I)=0
4170 NEXT I
4180 FOR I=1 TO ORDER+1
4190 RIGHT(I)=0
4200 NEXT I
4210 FOR POINT=1 TO N
4220 FOR I=1 TO ORDER*2
4230 SUM(I)=SUM(I)+X(POINT)^I
4240 NEXT I
4250 FOR I=1 TO ORDER+1
4255 IF I=1 THEN RIGHT(I)=RIGHT(I)+Y(POINT)
4260 IF I<>1 THEN RIGHT(I)=RIGHT(I)+Y(POINT)*X(POINT)^(I-1)
4270 NEXT I
4280 NEXT POINT
4290 MATRIX(1,1)=N
4300 FOR I=1 TO ORDER+1
4310 MATRIX(I,ORDER+2)=RIGHT(I)
4320 FOR J=1 TO ORDER+1
4330 IF I+J>>2 THEN MATRIX(I,J)=SUM(I+J-2)
4340 NEXT J
4350 NEXT I
4410 FOR K=1 TO ORDER
4420 KP1=K+1
4430 L=K
4440 FOR I=KP1 TO ORDER+1
4450 IF ABS(MATRIX(I,K))>ABS(MATRIX(L,K)) THEN L=I
) THEN L=I
4460 NEXT I
4470 IF L=K THEN 4530
4480 FOR J=K TO ORDER+2
4490 TEMP=MATRIX(K,J)
4500 MATRIX(K,J)=MATRIX(L,J)
4510 MATRIX(L,J)=TEMP
4520 NEXT J
4530 FOR I=KP1 TO ORDER+1
4540 FACTOR=MATRIX(I,K)/MATRIX(K,K)
4550 FOR J=KP1 TO ORDER+2
4560 MATRIX(I,J)=MATRIX(I,J)-FACTOR*MATRIX(K,J)
4570 NEXT J
4580 NEXT I
4590 NEXT K
4600 COEF(ORDER+1)=MATRIX(ORDER+1,ORDER+2)/MATRIX(ORDER+1,
ORDER+1)
4610 I=ORDER
4620 IP1=I+1
4630 TOTAL=0
4640 FOR J=IP1 TO ORDER+1
4650 TOTAL=TOTAL+MATRIX(I,J)*COEF(J)
4660 NEXT J
4670 COEF(I)=(MATRIX(I,ORDER+2)-TOTAL)/MATRIX(I,I)
4680 I=I-1
4690 IF I>=1 THEN 4620
4700 RETURN
5000 REM
5001 REM -- DISPLAY THE LSQ POLYNOMIAL
5002 REM -- COEFFICIENTS.
5003 REM
5110 GRAPHICS 0:POKE 752,1
5120 FOR NUMBER=1 TO ORDER+1
5130 PRINT "COEF(";NUMBER;"):",COEF(NUMBER)

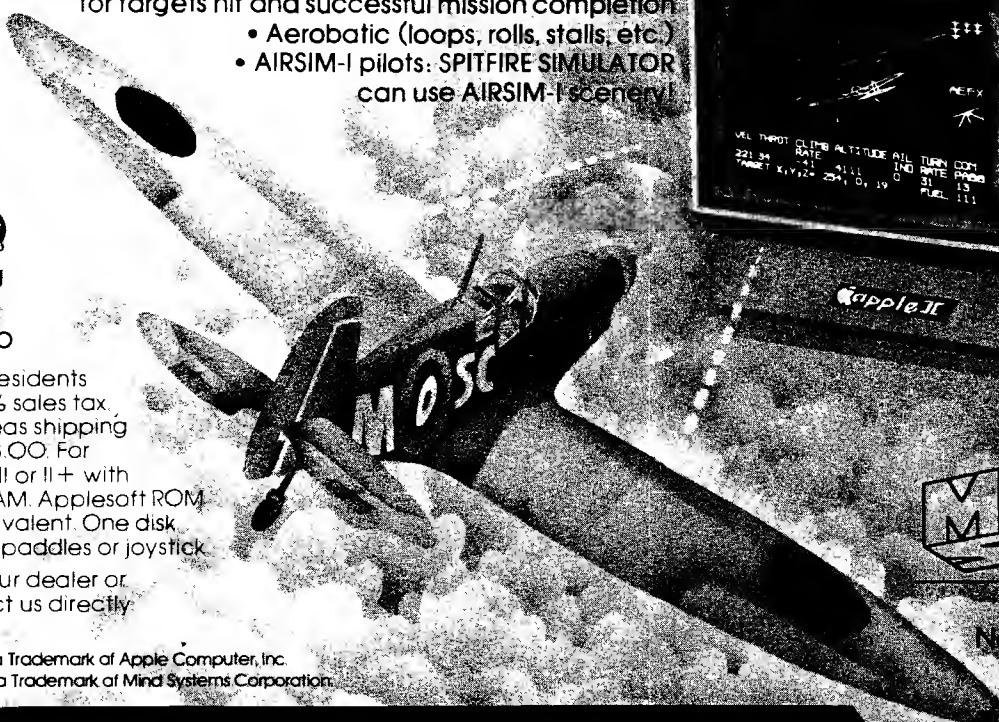
```

(continued)

A unique experience for those who love a challenge ... SPITFIRE SIMULATOR...

Fly a 360 mph Spitfire fighter • Pursue and attack 3-D target aircraft • Eight target types (Me 109, Fw 190, etc.) • Scores for targets hit and successful mission completion

- Aerobatic (loops, rolls, stalls, etc.)
- AIRSIM-I pilots: SPITFIRE SIMULATOR can use AIRSIM-I scenery!



\$40.00

Mass. residents add 5% sales tax.
Overseas shipping add \$3.00. For
Apple II or II+ with
48 K RAM, Applesoft ROM
or equivalent. One disk.
Game paddles or joystick.

See your dealer or
contact us directly.

Apple is a Trademark of Apple Computer, Inc.
AIRSIM is a Trademark of Mind Systems Corporation.



Mind Systems
Corporation

P.O. Box 506
Northampton, MA 01061
(413) 584-7045

Circle No. 38

OS9 APPLICATION SOFTWARE

ACCOUNTS
PAYABLE

\$299

ACCOUNTS
RECEIVABLE

\$299

GENERAL
LEDGER

with

CASH
JOURNAL

\$399

PAYROLL

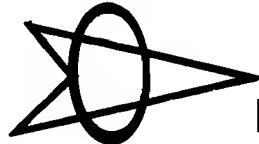
\$499

SMALL
BUSINESS
INVENTORY

\$299

COMPLETE DOCUMENTATION \$19.95

OS9 & BASIC 09 ARE TRADEMARK OF
MICROWARE, INC. & MOTOROLA CORP.



SPECIALTY
ELECTRONICS

(405) 233-5564

2110 W. WILLOW — ENID, OK 73701

Circle No. 39

—Next Month in MICRO—

July Features Hardware!

A comparison of all the microcomputers you have questions about:

- Atari 400, 800, and 1200XL
- VIC-20
- Commodore 64
- Apple IIe
- TTS-80 Color Computer
- Commodore 128
- Sinclair/Timex
- TI-99

Also: An Apple Clock Interrupt
PET Goes ROM
Pascal Solitaire
UltraPainter on the Atari
Interfacing the Atari Joystick to the Color Computer

Variables in LSQPOLY

The following major variables and arrays are used in LSQPOLY.

N	The number of calibration data points.
X(50)	The abscissa values of the calibration data.
Y(50)	The ordinate values of the calibration data.
ORDER	The highest degree, m, of the polynomial.
MATRIX(6,7)	The intermediate matrix of X values.
RIGHT(6)	The intermediate vector of XY values.
SUM(10)	The intermediate vector of X values used to fill MATRIX for Gaussian Elimination.
COEF(6)	The polynomial coefficients.
XMIN	The minimum abscissa limit for plotting.
XMAX	The maximum abscissa limit for plotting.
YMIN	The minimum ordinate limit for plotting.
YMAX	The maximum ordinate limit for plotting.
XINC	The data frequency of the plot, i.e. every XINCth fit data point will be plotted.
YFIT(159)	The least squares interpolated values between XMIN and XMAX to be plotted.

LSQPOLY allows the homebrew designer to visually analyze calibration data for trends and functional relationships. This tool is capable of generating a compact functional description of the data, allowing easy and accurate interpolation — even if the calibration data contains error.

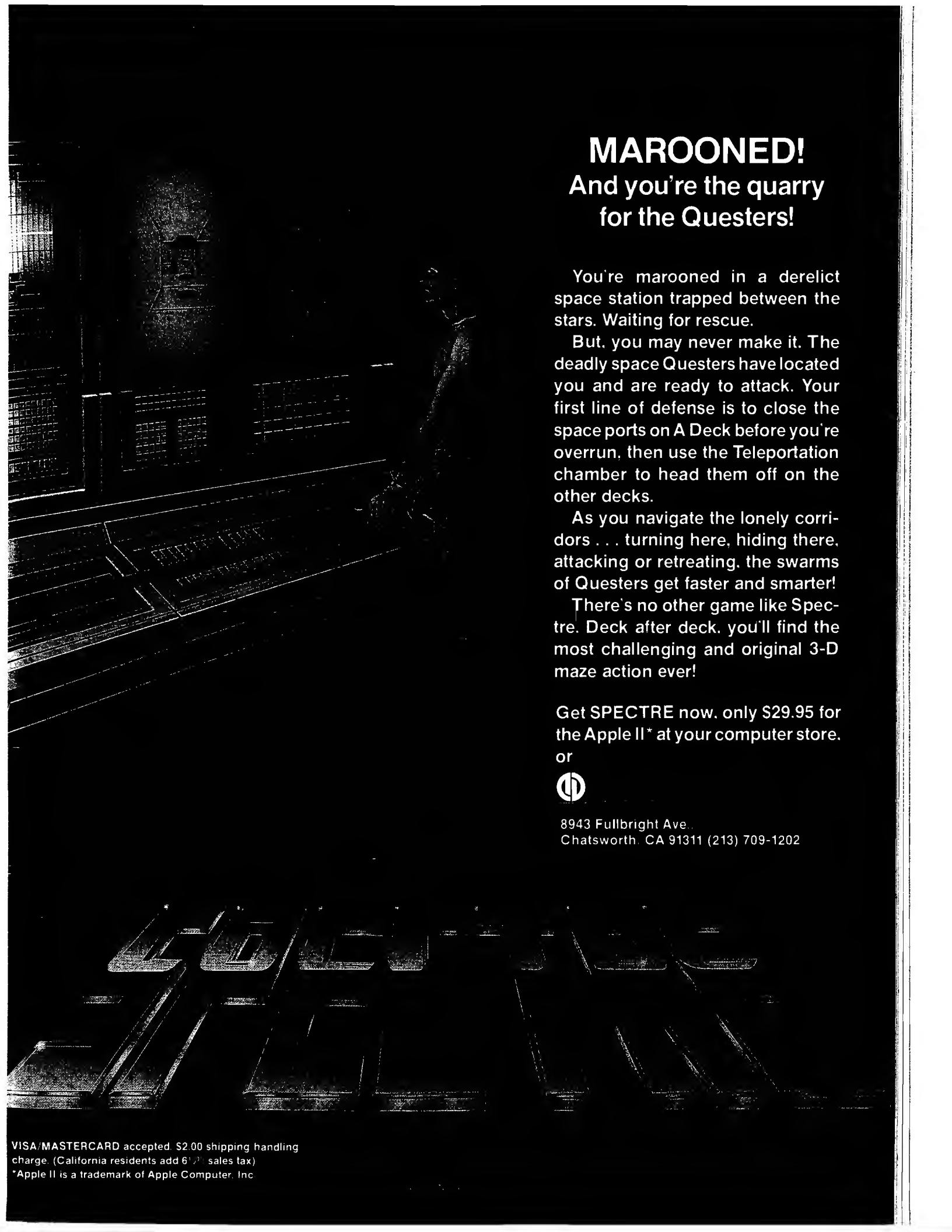
Although the plot routines are specific to the Atari 800, LSQPOLY should require little modification to execute the numerical routines on other BASIC systems. Computer systems supporting graphics resolutions of 160 x 80 or higher (such as Atari GRAPHICS 7 and 8) will allow LSQPOLY to be used most effectively.

Mike Dougherty has an M.S. degree in computer science, and is currently working at Martin Marietta Aerospace in Denver, CO. You may contact him at 7659 W. Fremont Ave., Littleton, CO 80123.

```

5140 NEXT NUMBER
5150 PRINT :PRINT "Press RETURN to continue";
5160 INPUT PAUSE$
5170 RETURN
6000 REM
6001 REM -- PLOT THE GENERATED LSQ FIT.
6002 REM
6010 GRAPHICS 0
6020 PRINT "Minimum y ";:INPUT YMIN
6030 PRINT "Maximum y ";:INPUT YMAX
6040 PRINT "Data Frequency ";:INPUT XINC
6050 X RANGE=XMAX-XMIN
6060 Y RANGE=YMAX-YMIN
6070 GRAPHICS 7
6080 SETCOLOR 2,0,0
6100 REM
6101 REM -- PLOT THE CALIBRATION DATA.
6102 REM
6110 COLOR 2
6120 FOR I=1 TO N
6130 IF (X(I)<XMIN) OR (X(I)>XMAX) THEN 6190
6140 IF (Y(I)<YMIN) OR (Y(I)>YMAX) THEN 6190
6150 X PLOT=INT(159*(X(I)-XMIN)/X RANGE)
6160 Y PLOT=79-INT(79*(Y(I)-YMIN)/Y RANGE)
6170 PLOT X PLOT,Y PLOT
6190 NEXT I
6210 PRINT "Press RETURN to continue";
6220 INPUT PAUSE$
6230 REM
6231 REM -- PLOT THE LSQ FIT DATA.
6232 REM
6300 COLOR 1
6310 FOR I=0 TO 159 STEP XINC
6320 IF (YFIT(I)<YMIN) OR (YFIT(I)>YMAX) THEN 6390
6330 Y PLOT=79-INT(79*(YFIT(I)-YMIN)/Y RANGE)
6340 PLOT I,Y PLOT
6390 NEXT I
6900 PRINT "Press RETURN to continue";
6910 INPUT PAUSE$
6920 RETURN
7000 REM
7001 REM -- FORM INTERPOLATION VALUES
7002 REM -- FROM THE LSQ POLYNOMIAL
7003 REM -- COEFFICIENTS. TERMINATE
7004 REM -- WITH AN X VALUE OF -9999.
7005 REM
7110 GRAPHICS 0
7120 PRINT "X (-9999 to RETURN) ";
7130 INPUT VALUE
7140 IF VALUE=-9999 THEN RETURN
7150 GOSUB 7900
7180 PRINT "y: " ;TOTAL:PRINT
7190 GOTO 7120
7900 REM
7901 REM -- COMPUTE THE POLYNOMIAL
7902 REM -- TOTAL FROM THE X VALUE.
7903 REM
7910 TOTAL=0
7920 FOR P=ORDER+1 TO 1 STEP -1
7930 TOTAL=TOTAL*VALUE+COEF(P)
7940 NEXT P
7950 RETURN
8000 REM
8001 REM -- GENERATE THE LSQ FIT DATA
8002 REM -- FOR THE VISUAL PLOT.
8003 REM
8010 GRAPHICS 0
8020 PRINT "Minimum x ";:INPUT XMIN
8030 PRINT "Maximum x ";:INPUT XMAX
8040 XINC=(XMAX-XMIN)/160
8050 GRAPHICS 0:POKE 752,1
8100 FOR XOFFSET=0 TO 159
8110 VALUE=XMIN+XOFFSET*XINC
8120 GOSUB 7900
8130 YFIT(XOFFSET)=TOTAL
8135 PRINT " Y(";VALUE;")=",YFIT(XOFFSET)
8140 NEXT XOFFSET
8150 RETURN

```



MAROONED!

And you're the quarry
for the Questers!

You're marooned in a derelict space station trapped between the stars. Waiting for rescue.

But, you may never make it. The deadly space Questers have located you and are ready to attack. Your first line of defense is to close the space ports on A Deck before you're overrun, then use the Teleportation chamber to head them off on the other decks.

As you navigate the lonely corridors . . . turning here, hiding there, attacking or retreating, the swarms of Questers get faster and smarter!

There's no other game like Spectre. Deck after deck, you'll find the most challenging and original 3-D maze action ever!

Get SPECTRE now, only \$29.95 for the Apple II* at your computer store, or



8943 Fullbright Ave.
Chatsworth, CA 91311 (213) 709-1202

VISA/MASTERCARD accepted. \$2.00 shipping handling charge. (California residents add 6 1/2% sales tax)

*Apple II is a trademark of Apple Computer, Inc.

As anyone who has been to a Pinewood Derby race can testify, the high point of the year is the race weekend. Pinewood Derby is a wood car race in which young boys and their parents spend hours making wooden cars roll down a track while 40 or so 4 to 10 year old boys and their parents cheer them on.

I myself discovered how competitive the racing became when I helped judge a race three years ago. Our track is a four lane, 10 foot wide cars race simultaneously. Each lane has two judges with keen eyesight and super-speed timing devices to determine the winner. The following year I designed an electronic judging and time keeping system using my AIM-65 computer and four optosensors.

With the computer judging system we found the Pinewood Derby to be much smoother and faster and there were fewer upset fathers and more happy judges. The computer selects the first, second, third, and fourth place finishers and gives each car a time to 1/1000 of a second.

The Set-up

The Pinewood Derby track consists of two parts. The incline and the horizontal. The incline is built so that it is horizontal on a 10 foot wide track. The track is covered with a thin layer of wood about 7/8" wide.

At the top of the incline there is a race box. The race box is built down the incline so that each car starts at the same time. The race box is built so that it is horizontal on a 10 foot wide track.

Pinewood Derby with Computer Timing

by Sidney S. Koegler

Richvale Telecommunications

10610 BAYVIEW (Bayview Plaza)
RICHMOND HILL, ONTARIO, CANADA L4C 3N8
(416) 884-4165

\$185⁰⁰ Canadian
\$149⁰⁰ U.S.
PLUS CUSTOMS BROKERAGE,
HANDLING AND MAILING CHARGE.

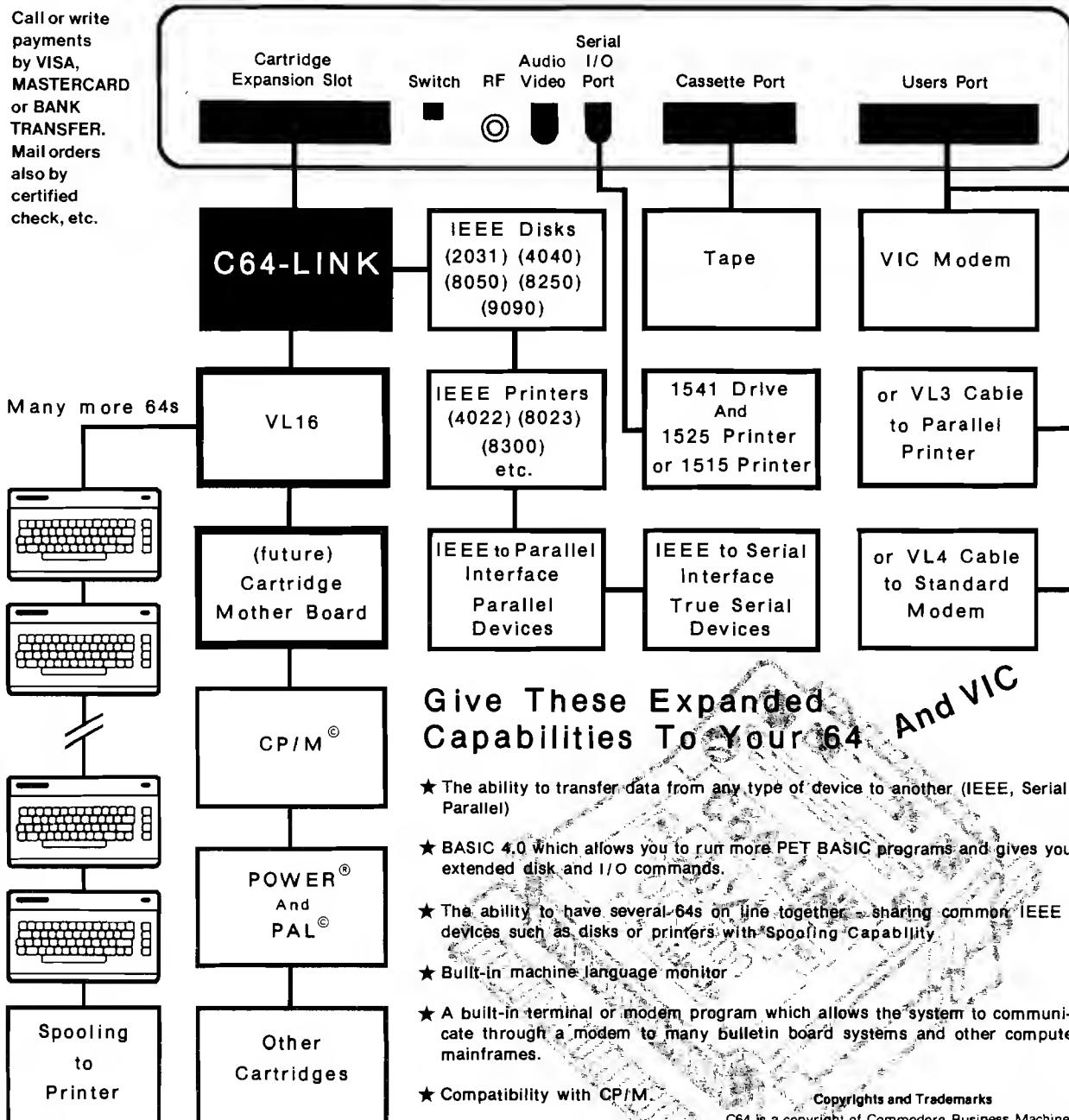
RTC

Also available
for VIC 20

C64-LINK[®] The Smart 64

RTC

Call or write
payments
by VISA,
MASTERCARD
or BANK
TRANSFER.
Mail orders
also by
certified
check, etc.



Contact your local Commodore dealer or RTC.

Copyrights and Trademarks
C64 is a copyright of Commodore Business Machines, Inc. C64-LINK is a copyright of Richvale Telecommunications. CP/M is a registered trademark of Digital Research. POWER is a trademark of Professional Software. PAL is a copyright of Brad Templeton

has been counted previously.

- If the car has not been counted before, the lane number and time are stored in a buffer.
- Control is returned to the BASIC program when all four cars have crossed the finish line or if a key is depressed on the AIM 65 keyboard; otherwise the routine loops back to the polling step above.

The running time (from the start of the race) is accumulated using the 16-bit timer of the 6522 VIA chip. Each time the VIA times out (.065 second), the value of CLOCK is incremented. This gives about 16 seconds timer capacity before the timer rolls over.

Three bytes are needed in the buffer to record the CLOCK value and the 16-bit timer value for each car or lane. This value is converted back to decimal in the BASIC program.

Conclusions

The electronic monitoring of a Pinewood Derby race is relatively easy and inexpensive for anyone owning an AIM 65 or similar microcomputer. This approach is software-oriented, since the only electronic components required are the optosensors. Although the AIM 65 was used here, with minor modifications the code could be used on the PET, KIM, or any 6502-based

machine that has four or five free 6522 VIA ports.

Sydney S. Koegler is a chemical engineer specializing in pilot-plant design and operation. You may reach Mr. Koegler at 2339 Carriage Ave., Richland, WA 99352.

Listing 1: BASIC Program for Pinewood Derby

```

100 REN...PINEWOOD DERBY
110 REN...4-23-82
115 V=40961:REN...VIA PORT A
120 REN...DATA BUFFER $FF0-$FFF
125 BS=4080:BT=BS+4:BU=BT+4:BV=RU+4
130 REN...SET POINTERS FOR SCAN ROUTINE
135 POKE 0,0:POKE 05,15
140 INPUT"ENTER HEAT NO. ",H$ 
160 INPUT"LANE NO. ";L
162 IF L=0 THEN 190
165 INPUT"CAR NO. ";C(L)
170 IF L<>4 THEN 160
190 PRINT" READY"
195 S=PEEK(V) OR 16
200 GET K$
205 IF K$="" AND S<>0 THEN 195
210 PRINT" T I N I N G"
215 XX=USR(0):REN...CALL SCAN ROUTINE
220 FOR I=1 TO 4
225 TN(I)=.065536*PEEK(BT+I)+.000256*
(255-PEEK(BU+I))
226 TN(I)=TN(I)+(255-PEEK(BU+I))*1E-6
227 TM(I)=INT(1000*TN(I))/1000
230 M=PEEK(BS+I)
233 IF M<=0 THEN P(I)=0:GOTO 250
235 P(I)=INT(1.1+LOG(N)/LOG(2))
240 NEXT
250 PRINT" :PRINT"HEAT ";H$ 
270 PRINT" PLAC LANE CAR TIME"
310 FOR J=1 TO 4
320 IF P(J)=0 THEN 350
330 PRINT" ";J;" ";P(J);";";C(P(J))
;TM(J)
340 NEXT J
350 GOTO 140

```

Listing 2: Assembly Listing of

Timing Routine

```

; . . . PIN21 4-23-82 . . .
; DETERMINES 1,2,3,4 PLACE
; IN PINEWOOD DERBY
; MODIFIED FOR TIMER FCTN
;
==0000 VIA=$A000 ;VIA BASE ADDRESS
==0000 T2L0=VIA+8 ;TINER LOW BYTE
==0000 T2HI=VIA+9 ;TINER HIGH BYTE
==0000 IFR=VIA+$0D ;INTERUPT FLAG
;REGISTER
==0000 PLACE=$0FF0 ;BUFFER -
;FINISHING PLACE
==0000 TINE1=$0FF4 ;BUFFER - TIME,
;HIGH BYTE
==0000 TINE2=$0FF8 ;BUFFER - TIME,
;MIDDLE BYTE
==0000 TINE3=$0FFC ;BUFFER - TIME,
;LOW BYTE
==0000 CLOCK=$0FEE ;ACCUMULATED TIME
==0000 TEMP=$0FEF ;TEMPORARY DATA
;STORAGE
==0000 OUT=$C0D1 ;AIM BASIC
;RE-ENTRY POINT
==0000 GETKEY=$E907 ;AIM MONITOR
;KEYBOARD STROBE
==0000 *=+$0F00 ;
;INITIALIZE VARIABLES
;
==0F00 START A9 00 LDA #0
; 8D 03 A0 STA VIA+3
; 8D EE 0F STA CLOCK
; A2 04 LDX #4
==0F0D INIT 9D F0 0F STA PLACE,X
; 9D F4 0F STA TINE1,X
;
```

(continued)



NO POWER SPIKES WITH SUPER FAN II.

Super Fan II's Zener Ray™ Transient Voltage Suppressor and Power Filter squelches spikes up to 6000 amps—even those caused by lightning—while responding up to 100 times faster than Apple II's

built-in suppressor.

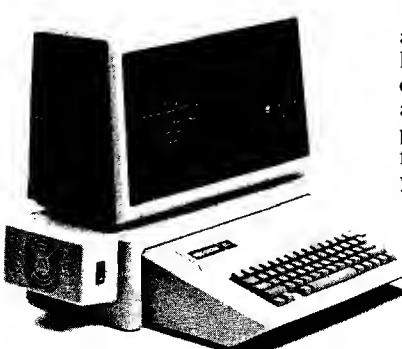
In addition, Super Fan II cools your Apple, removing heat buildup at a remarkable 17 cubic feet of air per minute. Yet it's the quietest fan of its kind on the market.

Super Fan II also positions a lighted on/off computer switch and two accessory plugs at your fingertips. It's warranted for two years and simply clips to your Apple II, IIe or monitor stand.

See your R.H. Electronics dealer today about Super Fan II*, or contact us at 566 Irelan Street, Buellton, CA 93427, (805) 688-2047.



RHELECTRONICS, INC.



Super Fan II, in black or tan \$109.
Without Zener Ray, \$74.95.
Additional air flow seals, \$5
Available in 240V/50 Hz

Dealer/OEM inquiries invited
*U.S. Patent #D268283
#4383286

France, call B/P 1-255-4463
Australia, call Imageneering (02) 212-1411

Circle No. 42

MICRO

```

9D FB OF STA TIME2,X
9D FC OF STA TIME3,X
CA DEX
D0 F1 BNE INIT
20 7B OF JSR CLICK

; SAMPLE VIA FOR PASSING CARS

==0F1F SCAN AD 01 A0 LDA VIA+1
8D EF OF STA TEMP

; TIMER TIMED OUT ?

A9 20 LDA #Z00100000
2C 0D A0 BIT IFR
F0 03 BEQ KEY
20 7B OF JSR CLICK

; CHECK FOR KEY DEPRESSED

==0F2F KEY 20 07 E9 JSR GETKEY
C9 FF CMP #$FF
F0 03 BEQ CHECK
4C D1 C0 JMP OUT

; CHECK EACH BIT FOR PASSING CARS

==0F39 CHECK A9 01 LDA #1
==0F3B CHECK1 2C EF OF BIT TEMP
D0 09 BNE STORE
==0F40 CHECK2 C9 08 CMP #8
F0 DB BEQ SCAN
18 CLC
2A ROL A
4C 3B OF JMP CHECK1

; STORE LANE NUMBERS
; IN THE CORRECT SEQUENCE

==0F49 STORE A2 01 LDX #1 (continued)

```

```

==0F4B STORE1 48 PHA
BD F0 OF LDA PLACE,X
F0 11 BEQ NEXT INO CAR ?
68 PLA
E0 04 CPX #4 LAST BIT ?
D0 03 BNE COMP
4C D1 C0 JMP OUT

; SEE IF LANE # ALREADY STORED

==0F59 COMP DD F0 OF CMP PLACE,X
F0 E2 BEQ CHECK2
E8 INX
4C 4B OF JMP STORE1

; STORE LANE # IN PLACE
; STORE TIMER VALUES
; GOTO NEXT BIT IN VIA

==0F62 NEXT 68 PLA
9D F0 OF STA PLACE,X
AD EE OF LDA CLOCK
9D F4 OF STA TIME1,X
AD 09 A0 LDA T2HI
9D F8 OF STA TIME2,X
==0F72 AD 08 A0 LDA T2LO
9D FC OF STA TIME3,X
4C 1F OF JMP SCAN

; TIMER ROUTINE
; (INCREMENTS 'CLOCK' EVERY .065 SEC)

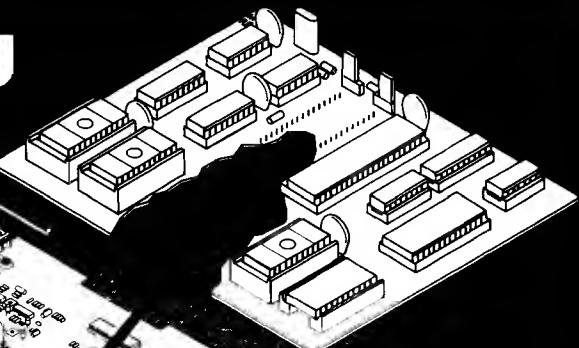
==0F7B CLICK 18 CLC
EE EE OF INC CLOCK
B0 09 BCS STOP
A9 FF LDA #$FF
8D 08 A0 STA T2LO
BD 09 A0 STA T2HI
60 RTS
==0F8A STOP 00 BRK

```

MICRO™

Take off and fly with the MACH-9

The 6809 adaptor for AIM-65*



MACH-9 Features:

"Just Released!"

MACH-9 Control Pascal

A superset of standard Pascal

No rom expansion board necessary

Sieve Benchmark**

Compiled Bytes	Total Bytes	Comp + Load	Execute
154	154	12 sec	264 sec

Introductory Price \$69.00 plus \$5.00 S&H US and Canada

*AIM-65 is a trademark of Rockwell International

and paste board • full 6809 socket •
zero BH static rom • 16 sockets for roms •
\$1239.00 plus 6.00 S&H*** US and Canada

For more information contact:
Modular Mining Systems, Inc. • 1110 E. Pennsylvania St.
Tucson, Arizona • 85714 • (602) 744-0418

In the UK Contact:

RCS Microsystems Ltd. • Gresham House
Twickenham Rd. • Feltham Middlesex •
TW13 6HA • 01-898-3775.



**Byte Magazine Sept. 1981 pg. 192

***\$20.00 S&H for overseas

Circle No. 43

$\frac{1}{2}$ $\frac{3}{4}$ $\frac{1}{3}$ $\frac{2}{3}$ **BASIC** $\frac{7}{8}$ $\frac{4}{5}$ $\frac{5}{6}$

**A BASIC program to automate
the calculation of fractions**

by LeRoy Moyer

Microsoft BASIC is a good language for doing numerical calculations when you want the result of an arithmetic computation to be in decimal notation. Sometimes, however, when working with fractions you would like the result of a computation to be a fraction. Often it is hard to convert the decimal result that is generated by BASIC into the fraction that it represents. For example, 0.23076923 is not easily recognized as the fraction 3/13. The fractions program I describe does all of its computations using fractions. That is, numbers are input as fractions and are output as fractions that have been reduced to their lowest common denominator.

Included in the program is an interpreter for the evaluation of one-line equations. The syntax for all equations in this interpreter is: [Variable Name] = [Algebraic Expression]. The algebraic expression may contain numerical fractions, previously defined variables, or the symbols (,), +, -, *, and /. Hierarchy for the mathematical operations is the same as in BASIC. An example of a valid expression is: VARIABLE = $\frac{3}{4} + X / \frac{2}{3}$ when X has been defined previously. After this equation has been typed into the computer and return is pressed, the value of

VARIABLE is calculated, stored in memory under that name, and the value is printed on the next line. Variable names can be any length and all characters are significant.

Interpretation of the equation is accomplished by using two stacks — one for operators (OP\$) and one for numeric values of the fraction (ST and SB). When a number is encountered in the equation it is put on the number stack with the numerator in ST and the denominator in SB. If a variable name is encountered, then the variable is first looked up in the variable name table (VN\$) before the numeric value associated with that variable is transferred to the number stack. Finally, when an operator is encountered the precedence is compared with the precedence of the operator on the top of the operator stack. If the precedence of the new operator is higher, then the operator is placed on the operator stack; otherwise the top operator on the stack is used and the operator stack is reduced by one. This continues until the end of the equation at which time all remaining operations on the stack are completed and the results are printed out.

The listing of the program is commented extensively, but none of the

REM statements are used as references and so they can be eliminated to make the program shorter and faster. The program logically starts at line 1000, which initializes the arrays. An equation is input as a string (LN\$) at line 1100. First, the defined variable (VS\$) is separated out of LN\$ in line 1150 by looking for a blank space or an equal (=) sign. The subroutine starting at line 1700 then checks to see if there is a unary minus sign. If a minus sign is found, the symbol] is put on the operator stack and used only inside the program. Any symbol will work but this particular symbol is not used commonly on the Apple, for which this program was originally written. From this point, the program steps through the rest of the line (LN\$) checking to see if the next part of the equation is a variable (line 1240), a number (line 1250), or a symbol (line 1260). If it is one of these types of items, the program then goes to lines 1500, 1400, or 1300, respectively, for each type.

The section of the program starting at line 1300 handles the symbols in the equation. First it checks to see if the symbol was a (since this has the highest precedence. If it is, the program

(continued on page 67)

Listing 1: Applesoft Listing for Fractionated BASIC

```

10 GOTO 1000
95 REM ADDITION/SUBTRACTION
100 T = T1 * B2 + T2 * B1:B = B1 * B2: GOTO 130
105 REM MULTIPLICATION
110 T = T1 * B2:B = B1 * B2: GOTO 130
115 REM DIVISION
120 T = T1 * B2:B = T2 * B1
125 REM REDUCE THE FRACTION T/B TO LOWEST TERMS
130 IF T = 0 THEN B = 1: RETURN
140 IF B = 0 THEN PRINT "DIVISION BY ZERO":
    POP: GOTO 1100
150 TA = ABS (T):TB = ABS (B): IF TA < TB THEN
    TM = TA:TA = TB:TB = TM
160 DV = INT (TA / TB):R = TA - TB * DV
170 IF 0 = R THEN 190
180 TA = TB:TB = R: GOTO 160
190 T = SGN (B) * T / TB:B = ABS (B) / TB: RETURN
395 REM DO THE LAST OPERATION ON THE OPERATOR STACK
396 REM IF NO OPERATORS YET THEN PUT THE OPERATOR
    ON THE STACK
400 IF NP = 0 THEN NP = 1:OP$(NP) = TS$: RETURN
410 IF OP$(NP) = "<" THEN NP = NP + 1:OP$(NP) = TS$:
    : RETURN
415 REM CHECK FOR A UNARY MINUS AND DO IF ON
    OPERATOR STACK
420 IF OP$(NP) = "]" THEN ST(NS) = - ST(NS):
    OP$(NP) = TS$: RETURN
425 REM PULL TOP TWO NUMBERS OFF OF STACK FOR
    OPERATION
430 T1 = ST(NS - 1):B1 = SB(NS - 1):T2 = ST(NS):
    B2 = SB(NS)
435 REM PICK THE PROPER SUBROUTINE TO GO TO
440 IF OP$(NP) = "(" THEN GOSUB 110: GOTO 450
450 IF OP$(NP) = "/" THEN GOSUB 120: GOTO 480
460 IF OP$(NP) = "+" THEN GOSUB 100: GOTO 480
470 T2 = - T2: GOSUB 100
475 REM STORE THE RESULT BACK ON THE NUMBER STACK
480 NS = NS - 1:ST(NS) = T:SB(NS) = B:OP$(NP) = TS$:
    : RETURN
995 REM START OF THE PROGRAM
1000 DIM VN$(200), VT(200), VB(200),
    OP$(50), ST(100), SB(100)
1010 NV = 0
1020 REM READ IN A LINE TO BE EVALUATED
1100 INPUT "#"; LNS
1105 REM CHECK TO SEE IF VARIABLES ARE TO BE PRINTED OUT
1110 IF LEFT$(LNS,1) = "?" THEN FOR Z = 1 TO NV:
    PRINT VN$(Z); " "; VT(Z); "/"; VB(Z): NEXT Z: GOTO 1100
1120 LG = LEN (LNS):CN = 1:NP = 0: NS = 0
1125 REM SKIP LETTERS UNTIL A BLANK OR = SIGN ARE FOUND
1130 IF MID$(LNS,CN,1) = " " OR MID$(LNS,CN,1)
    = "=" THEN 1160
1140 IF CN < LG THEN CN = CN + 1: GOTO 1130
1150 PRINT "SYNTAX ERROR": GOTO 1100
1155 REM THE VARIABLE BEING DEFINED IS VS$
1160 VS$ = LEFT$(LNS,CN - 1)
1170 IF MID$(LNS,CN,1) = "=" THEN 1200
1180 IF CN < LG AND MID$(LNS,CN,1) = " " THEN
    CN = CN + 1: GOTO 1170
1190 GOTO 1150
1195 REM CHECK FOR A UNARY MINUS SIGN
1200 GOSUB 1700
1210 CN = CN + 1
1220 IF MID$(LNS,CN,1) = " " AND CN < LG THEN 1210
1230 IF CN > LG THEN 1600
1235 REM FIND THE FIRST CHARACTER AFTER THE =
1240 TS$ = MID$(LNS,CN,1): IF TS$ = > "A" AND
    TS$ < = "Z" THEN 1500
1245 REM IF A NUMBER - GOTO 1400 TO GET NUMBER
1250 IF TS$ < = "9" AND TS$ = > "0" THEN 1400
1255 REM IF A SYMBOL - GOTO 1300 TO EVALUATE
1260 IF TS$ = "(" OR TS$ = ")" OR TS$ = "+" OR TS$ =
    = "-" OR TS$ = "*" OR TS$ = "/" THEN 1300
1270 GOTO 1150
1295 REM THIS SECTION CHECKS THE PRECEDENCE OF
    THE OPERATORS
1296 REM IF A ( - PUT IT ON THE STACK AND CHECK
    FOR A UNARY -
1300 IF TS$ = "(" THEN NP = NP + 1:OP$(NP) = "(":
    GOSUB 1210: GOTO 1210
1305 REM CHECK FOR + OR -. IF FOUND DO THE PREVIOUS
    OPERATOR
1310 IF TS$ < > "+" AND TS$ < > "-" THEN 1330
1320 GOSUB 400: GOTO 1210
1325 REM IF PRESENT OP IS * OR / AND PREVIOUS
    OP IS * OR / THEN DO

```

(continued)

```

1330 IF TS$ < > ")" AND (OP$(NP) < > "+" AND
    OP$(NP) < > "-") THEN 1320
1335 REM OPERATION IS NOT TO BE DONE SO PUT IT
    ON STACK
1340 IF TS$ < > ")" THEN NP = NP + 1:OP$(NP) = TS$:
    GOTO 1210
1345 REM WORK BACK TO NEXT ( TO COMPLETE A () )
    EXPRESSION
1350 IF OP$(NP) = "(" THEN NP = NP - 1: GOTO 1210
1360 GOSUB 400: IF NP > 0 THEN NP = NP - 1: GOTO 1350
1370 PRINT "STACK ERROR": GOTO 1100
1395 REM EVALUATE A NUMBER
1396 REM GET THE FIRST NUMBER
1400 T = VAL ( MID$(LNS,CN)):CN = CN + LEN ( STR$(T))
1410 IF CN = > LG THEN B = 1: GOTO 1450
1420 IF MID$(LNS,CN,1) = " " THEN CN = CN + 1:
    GOTO 1410
1425 REM IF THE NEXT SYMBOL IS NOT A / THEN NOT
    A FRACTION
1430 IF MID$(LNS,CN,1) < > "/" THEN B = 1:CN =
    CN - 1: GOTO 1450
1440 CN = CN + 1:B = VAL ( MID$(LNS,CN)):CN = CN
    + LEN ( STR$(B)): IF B = 0 THEN PRINT "DIVISION
    BY 0": GOTO 1100
1445 REM PUT NUMBER ON THE STACK
1450 NS = NS + 1:ST(NS) = T:SB(NS) = B: GOTO 1210
1495 REM FIND THE NAME AND VALUES OF A VARIABLE
1500 CS = CN
1510 TS$ = MID$(LNS,CN,1)
1515 REM LOOK FOR A CHARACTER THAT IS NOT IN THE
    VARIABLE
1520 IF TS$ = " " OR TS$ = ")" OR TS$ = "+" OR TS$ =
    = "-" OR TS$ = "*" OR TS$ = "/" THEN CN = CN - 1
    : GOTO 1540
1530 IF CN < LG THEN CN = CN + 1: GOTO 1510
1535 REM FOUND THE NAME OF THE VARIABLE TS$
1540 TS$ = MID$(LNS,CS,CN - CS + 1):I = 1
1550 IF NV = 0 THEN 1550
1555 REM IF VARIABLE FOUND PUT ITS VALUE ON THE STACK
1560 IF TS$ = VN$(I) THEN NS = NS + 1:ST(NS) = VT(I):
    SB(NS) = VB(I): GOTO 1210
1570 IF I < NV THEN I = I + 1: GOTO 1560
1575 REM IF VARIABLE NOT FOUND IN LIST QUIT
1580 PRINT "VARIABLE "; TS$; " NOT DEFINED": GOTO 1100
1595 REM END OF EQUATION REACH - DO REST OF
    OPERATORS ON STACK
1600 IF NP > 0 AND OP$(NP) = "(" THEN NP = NP - 1
    : GOTO 1600
1610 IF NS > 1 AND NP > 0 THEN TS$ = "#":
    GOSUB 400:NP = NP - 1: GOTO 1600
1615 IF NP = 1 AND OP$(NP) = "]" THEN TS$ = "#":
    GOSUB 400: GOTO 1630
1620 IF NP < > 0 THEN PRINT "STACK DISJOINT":
    GOTO 1100
1625 REM PRINT OUT THE RESULTS
1630 PRINT VS$; " "; ST(1);: IF SB(1) < > 1 THEN
    PRINT "/"; SB(1);
1640 PRINT : I = 1
1645 REM SEE IF VARIABLE HAS BEEN USED BEFORE
1646 REM IF IT HAS PUT NEW VALUES IN
1650 IF NV = 0 THEN NV = 1:VN$(NV) = VS$:VT(NV) =
    ST(1):VB(NV) = SB(1): GOTO 1100
1660 IF VS$ = VN$(I) THEN VT(I) = ST(1):VB(I) = SB(1)
    : GOTO 1100
1670 IF I < NV THEN I = I + 1: GOTO 1660
1675 REM IF VARIABLE NOT USED BEFORE DEFINE A
    NEW VARIABLE
1680 NV = NV + 1:VN$(NV) = VS$:VT(NV) = ST(1):VB(NV)
    = SB(1): GOTO 1100
1695 REM SEARCH FOR THE NEXT CHARACTER TO SEE IF -
1700 CN = CN + 1: IF MID$(LNS,CN,1) = " " THEN 1700
1710 IF MID$(LNS,CN,1) < > "-" THEN CN = CN - 1:
    RETURN
1715 REM IF MINUS PUT SPECIAL SYMBOL ON OPERATOR STACK
1720 NP = NP + 1:OP$(NP) = "]": RETURN

```

Fractionated
requires:

Microcomputer with Microsoft
BASIC

OSI — OSI — OSI — OSI

192K RAM BOARD

ONLY **\$895**

The CCS - 192K is divided into

4 - 48K bank partitions.

*Each board can be dip switch
selected for 1 of 4 192K banks.*

*When combined with our CPU
the 192K RAM Board implements a
four user computer system at a
logic cost of \$1595 (special package price).*

*Combine this logic package
with our TiliOS Operating System
and you have a multi-user computer
with throughput that has to be
seen to be believed.*

Circle No. 44

7250 COMMERCE CIRCLE EAST • FRIDLEY, MINNESOTA 55432 • PHONE (612) 574-9493
(800) 328-2419

puts a (on the operator stack, checks for a unary minus sign, and then returns to line 1210 for the next item in the equation. In line 1310 the program checks to see if a + or - sign was the symbol encountered. If it was, this implies that the precedence was such that the last operation on the stack should be done since these are the lowest precedence. The program accomplishes this by jumping to the subroutine starting at line 400, which checks the symbol on the top of the operator stack and then does the required operation. If the operation is +, -, *, or / then the appropriate subroutine starting at line 100, 110, or 120 is called. These routines for binary operations in lines 100 to 120 in turn feed into line 130, which reduces the fraction to the lowest common denominator. Upon return to the subroutine starting at line 400, the result of the operation is placed on the number stack and the program returns to get the next part of the equation.

The next check (line 1330) is to see if the present symbol is a * or / and the operator on the top of the operator stack is also a * or /. If this is true, then the operation is done by jumping to the subroutine at line 400; otherwise (line 1340) the symbol * or / is put onto the operator stack since it has a higher precedence and is not to be done yet. Finally if a) is encountered, the program unfolds the operator stack until a (is encountered.

Starting at line 1400 the program interprets a number by using the VAL function. If the first number is not followed by a / then the number is assumed to be a whole number and the denominator is set to 1. The numerator and denominator are put on the number stack in line 1450.

In the section of the program starting at line 1500, we parse out the name of a variable used in the equation to be evaluated. This is accomplished by stepping through the characters in LN\$ until a character is found that cannot be part of the variable name. After this name is found in line 1540 the list of previously defined variable names is searched. If the name is not found in the list then an error message is printed; otherwise the value associated with that variable, stored in VT and VB, is put on the stack.

Eventually the program comes to the end of the equation it is evaluating and must complete all of the operations that are left on the stack. This is accomplished by the code starting at line 1600. The value calculated is then

printed on the screen along with the variable name in line 1630. A search of the variable name list is made to see if this variable has been defined before. If the variable has been defined, then the values are substituted in, and if it has not been defined, then a new variable is created. The program then jumps to line 1100 to get another equation to evaluate.

Fairly complex calculations with fractions are made easier by using this program. It is possible, however, to expand the program to make it even easier to use. For example, with the addition of an editor and a few control commands, the program could be expanded to enable you to write programs

that work in fractions similar to the way BASIC works with decimals. Another possible way to change the program is to redefine the arithmetic so that the two numbers now representing the numerator and denominator are interpreted to be the real and imaginary parts of a complex number; then one could have a calculator that does complex number arithmetic.

LeRoy Moyer is a physicist for the Army and teaches computer programming part time at Piedmont Virginia Community College. You may contact him at Rt. 9, Box 236, Charlottesville, VA 22901.

MICRO

"POWER FAILURE"

Goodbye valuable data. Unless you have a Guardian Angel uninterrupted power source on duty.

Guardian Angel switches to 150 watts of backup power in 1/100 of a second or less while alerting you of blackout or brownout conditions. Its rugged 12V battery gives you up to six minutes (15 at half-rated power), enough to save your data and shut down your system if line power does not return.

Guardian Angel is compatible with virtually every major microcomputer system, including Apple, IBM, H-P, TRS-80, Xerox, Eagle and Osborne. Its transient voltage suppressor also prevents system damage from power spikes.

Guardian Angel simply plugs in between your power source and your microcomputer. Its compact size permits either desktop use or out of the way placement.

Protect your investment: see your R.H. Electronics dealer today about Guardian Angel or contact us at 566 Irelan Street, Buellton, CA 93427, (805) 688-2047.



Guardian Angel™, with LED power status indicator, automatically safeguards data from blackouts, brownouts for just \$595

RHELECTRONICS, INC.

*Patents pending, UL listed, FCC approved, 240V/50 Hz version available. Dealers and OEM inquiries invited.

Circle No. 45

The Avant-Garde Programmer's Series:

A HI-RES ELECTRONIC DESIGN

Create and print electronic circuit plans. Keyboard selection and rotation of 98 different electronic components. Paddles or joysticks provide easy placement. \$29.95

A HI-RES SECRETS GRAPHICS APPLICATIONS SYSTEMS

Step from Basic to better Basic programs, Basic to Assembly hi-res graphics, electronic Create graphics, electronic and architectural designs, arcade and adventure games, more! Fastest color-fill: 300 colors/patterns. \$75.00

A HI-RES SECRETS

Complete Apple® graphics utility fills the needs of today's creative programmer. 263 pages of revealing documentation. Completely relocatable color or graphic, animation and sound routines. The most useful package on the market. \$125.00. Demo available \$10.00

A HI-RES ARCHITECTURAL DESIGN

Plan and design individual rooms, complete floor plans, total buildings, 75 different floor plan shapes can be easily rotated and moved. Lengths, diagonals and angles are calculated on-screen. \$29.95

A SUPER QUALITY EPSON HI-RES DUMP

Best quality Epson dump features. Mirror, black copy, or rotated negative flip or rotated images available in three sizes. Automatic horizontal centering. \$25.00

A SUPER SHAPE DRAW AND ANIMATE

Draw in any direction using keyboard commands. Two types of animation, rotation, scale, background color, shape color and more. \$34.95

ACTION SOUNDS AND HI-RES SCROLLING

Machine language sounds, hi-res scrolling routines and Super-font program in one useful package. \$18.95

A PAINT MASTER SCENE UTILITY

Allows line drawing, scene painting, scene editing, screen color, fill routines, anywhere. Perfect for adventure game creation or computer art. Over 300 colors/patterns. Use your own program. \$34.95

Why Better?

Because There Are No Secrets!

Most of these programs are unprotected or completely listable and may be used in all your creations, with no royalties required. They turn novices into professionals and professionals into absolute magicians!

Now Available from Your Local Software Dealer and by calling us directly at

(503) 345-3043

AVANT-GARDE CREATIONS, INC.

P.O. Box 30160 Eugene, OR 97403

ARE YOUR CREATIONS MARKETABLE? ARE YOU A QUALIFIED PROGRAMMER LOOKING FOR ASSIGNMENTS? GIVE US A CALL

The **MICRO** **LEARNING CENTER**

Atari 800

Texas Instrument

Features:



- **Four-Color Hi-Res Graphics for the VIC-20**

by Brian S. Zupke

Use the joystick to draw pictures in four different colors.

- **VIC Player**

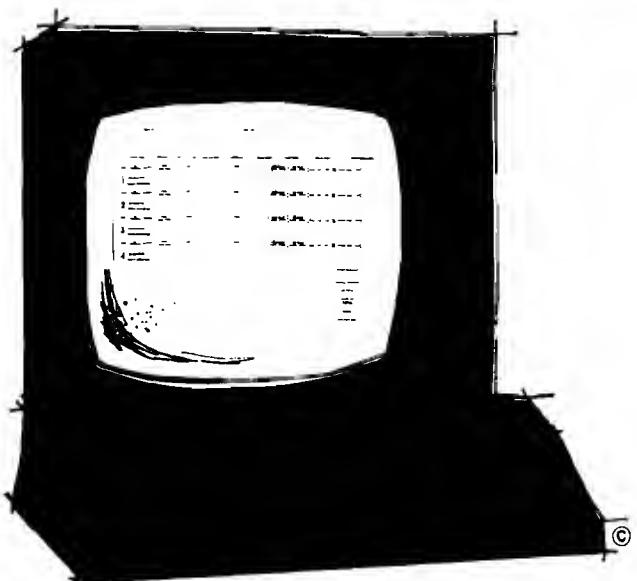
by Phil Daley and Bob Tripp

A five-octave keyboard program.

- **An Inexpensive Joystick for the VIC-20, C64, and Atari**

by David A. Bryson

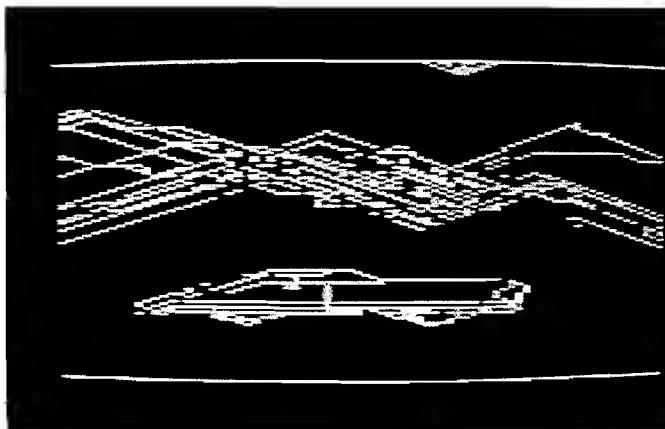
For only \$15.00 and two hours time, you can have a lightpen for all three machines.





Four Color High-Res Graphics for The VIC-20

by Brian S. Zupke

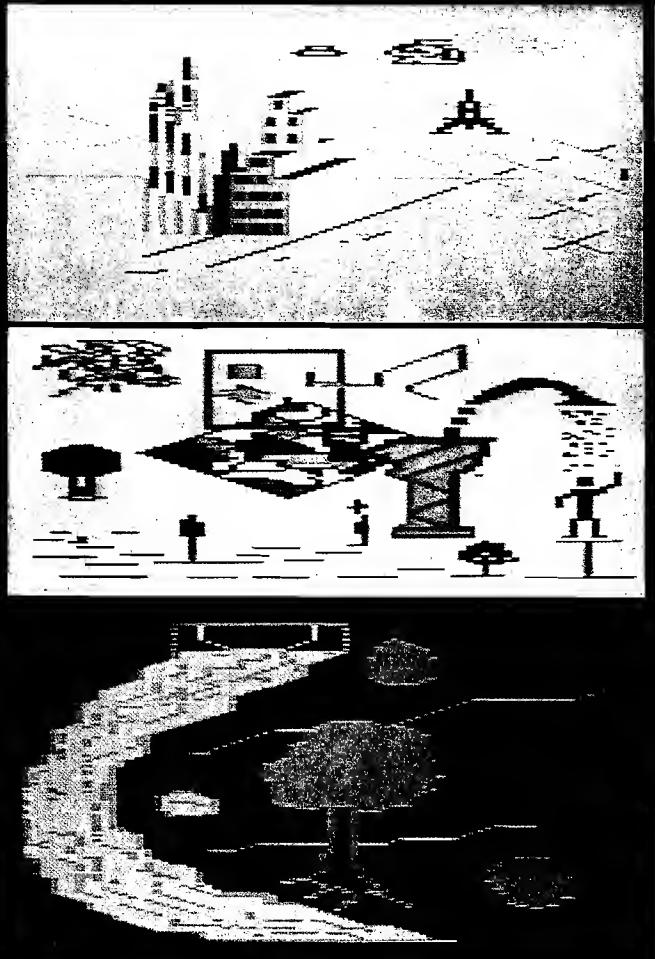


Multicolor mode graphics on the VIC-20.

Many VIC-20 programmers know how high-resolution graphics are done — but with only two colors (screen color and character color). The VIC is capable of displaying four-color hi-res graphics using the multicolor mode. The question is how is it done?

In order for the VIC to distinguish among four colors within one character, a sacrifice has to be made. First, with two-color graphics each pixel in a character has only two states: on or off. One bit is needed to address each pixel. Using the multicolor mode, there are four states in which a pixel can be. Two bits are necessary for describing each pixel. This means that the VIC either must use twice as much memory for the character-bit map to have the same resolution, or it must have half the normal resolution. The VIC is incapable of the first alternative, so you are stuck with a lower resolution. Each color pixel is twice as wide (two regular pixels) as it is high. The entire screen has a total resolution of 16,192 pixels in this mode, and each character becomes 4 pixels wide and 8 or 16 pixels high.

The four colors available in the multicolor mode are screen color, border color, character color, and auxiliary color. Whether the multicolor mode for a character is used or not is determined



Photos taken from AMDEK Color I Monitor.

by the value of the corresponding color memory location. If bit 3 is set, or if the value of the location is from 8 to 15, then the computer views that character as multicolored. It is possible to have regular graphics and multicolored graphics on the screen at the same time by setting the color memory locations accordingly.

Screen color is designated by a 00 (binary) value. If a pixel in a multicolored character has this value, then it will be the same color as the screen. Border color is designated by 01, character color by 10, and auxiliary color by 11. The value of the auxiliary color is located in the four most significant bits of location 36878. It can have a value of from 0 to 15 and is set by

```
POKE 36878,16 * COLOR  
or, if you are also using sound,  
POKE 36878,PEEK(36878) AND 15 OR  
(16 * COLOR)
```

Although only four colors can exist in a character at one time, the colors can be changed easily by changing the color of the screen, border, character, or auxiliary color.

To address multicolor graphics on the screen, a method similar to the one used in two-color plotting is used. The double characters (8 x 16 pix-

els) are used, and plotting is done by ANDing and ORing bytes in the character memory, except now you have two bits to change at the same time.

First you must determine which character contains the pixel to be changed. The grid will be 20 characters wide (80 color pixels) and eight characters high (128 color pixels). Finding the correct character is done by

$$\text{CHAR} = 20 * \text{INT}(Y/16) + \text{INT}(X/4)$$

where X and Y are the coordinates of the point. Y is divided by 16 since each character is 16 pixels high, and it is multiplied by 20 for the 20 characters in each row. X is divided by 4 since there are only four pixels across each character. To determine which byte is to be changed, you must use

$$\text{BYTELOC} = \text{BASE} + 16 * \text{CHAR} + Y - \text{INT}(Y/16) * 16$$

where BASE is the base address of the character bit map. CHAR is multiplied by 16 to skip over the 16 bytes of each character preceding it in the table. The remainder of Y divided by 16 gives the correct byte in the character to be changed. Sounds all too familiar, right? Now for the hard part. You must leave six of the eight bits unchanged and change the two correct bits to the color you want. First determine which of the four pairs of bits to change:

$$\text{PAIR} = 4 \uparrow (3 - (X - \text{INT}(X/4) * 4))$$

The remainder of X divided by 4 determines which pair of bits is to be changed. It has a value of from 0 to 3. By raising 4 to the reverse-of-this-remainder'th power (3,2,1,0 instead of 0,1,2,3),

the base value of the pair is known. It is the value of the least significant of the two bits in each of the four pairs. Now the color value to be plotted must be replaced with the value that already exists in the bit pair. These two bits must be cleared first. This is done by ANDing the pair with zeros and the remaining six bits with ones:

$$\text{BYTE} = \text{BYTE AND } (255 - \text{PAIR} * 3)$$

Now that the bit pair has been cleared, you can add the color you want by ORing the cleared bit pair with the value of that color (from 0 to 3):

$$\text{BYTE} = \text{BYTE OR } (\text{PAIR} * \text{COLOR})$$

When the value of BYTE is placed back into the bit map, the added color will be displayed.

The program COLOR DRAW runs on an unexpanded VIC and requires a joystick. Adding the 3K expander will allow you to add more features, but adding 8K or more will, surprisingly, result in not enough memory for the program! By moving the start of BASIC to the beginning of the expansion RAM, you can avoid this problem. The screen, border, character (all characters have the same color in this program), and auxiliary colors may be changed at any time by pressing "C". The computer will ask for their values. The auxiliary and screen colors can be from 0 to 15 while the border and character colors are from 0 to 7. Table 1 shows which color corresponds to each number.

The four function keys are used to switch between the colors (screen, border, etc.): F1 is the screen color, F3 is the border color, F5 is the character color, and F7 is the auxiliary color. The joystick is used to direct the blinking cursor. If you wish to move the cursor without disturbing the screen then hold the fire button down when you move it, which allows you to cross over different colors.

MICRO

Listing 1

Value	Color
0	BLACK
1	WHITE
2	RED
3	CYAN
4	PURPLE
5	GREEN
6	BLUE
7	YELLOW
8	ORANGE
9	LIGHT ORANGE
10	PINK
11	LIGHT CYAN
12	LIGHT PURPLE
13	LIGHT GREEN
14	LIGHT BLUE
15	LIGHT YELLOW

Table 1

```

14 POK E56,20:POKE 240,17:Y=56:I=71,20:D=16:FB=37152:DD=FB+2:RA=FB-1
26 INPUT"NEW SCREEEN":A$=I:FB=4:Y":THENFOR :=TTBT+2540:POKE I,0:NEXT
30 DEFPRM:J=4:R=3:G=0:BE=1:RDE
100 FOR EY=15,16:POKE V+14,16:POKE 16,20:POKE 15,20:POKE Y,5:NEXT
110 POKE V+3,47:POKE V+5,253:POKE V+7,254:POKE Y,0:NEXT
120 FOR X=0TO15:R=8:BE=7728:Y=16+X:POKE A,X:POKE S,A:POKE S,A:POKE Y,0:NEXT:Y=16
130 X=16:Y=16+X:R=8:BE=7728:Y=16+X:POKE A,X:POKE S,A:POKE S,A:POKE Y,0:NEXT:Y=16
140 SH=4+(D$+Y-(D$+Y)-(D$+Y)-(D$+Y)):SC=PEEK(SA+10)=SC:GOTO150
150 GOSUB2000:GETRF:IFRF=0:THENM=0:GOTO170
160 F=RSC:R=3+1:IFN=1,2:THENM=K-1:R3
170 IFN=6:THENM=SUB(1698):GOTO160
180 POK E00,127,25:NOTFEEN:PA=1:ANDED=1:(PEEK(18)+0):POKE D,255
190 IFM=0:THEINH=1:IFN=1,2:THENM=K-1:IFN=16:Y=4:GHI:KANDS 1-SGN KAND41:GOTO210
298 GOTO150
210 IFM=2:THEINH=2:R=0
220 IFN=0:THEINH=0
230 IFY=12:THEINY=127
240 IFY=0:THEINY=0
250 IFKANDS2>0:THENSC=2:RND(255-FNA,3):Y=PEEK(18)
260 POKE S,A,3C
270 GOTO130
1980 POKE V+3,46:POKE V+5,240:POKE V+15,27:INPUT"SCREEN,BOP,CHA,PIX":S,B,C,A$=I+1:R=15
1810 R=R*D:W=S*D+B:PRINT":RETURN"
2000 IFFTHEINH=0:GOTO1255-FNA,32:Y=PEEK(13):GOT32024
2110 F=1:R=0:RND(275-FNA,3):Y=PEEK(3-J)
2200 POKE S,A:RETURN

```

You may contact Mr. Zupke at 5152 Marcella Ave., Cypress, CA 90630.



vic PLAYER

**Convert your VIC into a simulated organ with VIC Player.
The keys of the organ are represented by the keys on
the VIC keyboard.**

by Phil Daley and
Bob Tripp

With the VIC Player installed in your computer you can make your VIC an entertaining and instructive device. Each note you play can be heard on the VIC sound registers. The keyboard spans three complete octaves, and the range can be extended by selecting among three overlapping registers for a total range of five octaves! Each note that is played is stored in memory so that it can be instantaneously replayed or saved on cassette tape for later use. Then you can load your song from cassette tape and replay it.

We have included a feature in VIC Player that allows you to stop playing, go back to correct mistakes, replay the song from the beginning to the current note, and then continue playing additional notes.

Using the VIC Player

After choosing the 'PLAY SONG' option from the menu, a representation of the VIC keyboard is

printed on the screen in the format of a two-keyboard organ. The bottom row of keys represents the lowest notes starting with 'C' and ascending alphabetically. The second row of keys represents the sharps and flats (black keys) that correspond to the first row. Note that there are in-between keys on the second row of the VIC for every pair of first row notes. This is different than the normal organ keyboard and means that some of the second row keys do not sound when pressed (A, F, and K). These keys can be used to introduce rests into your song.

The third row of keys represents the second keyboard of the organ starting at middle 'B' and ascending to high 'C'. 'C' is not listed on the screen display due to space limitations, but is available by pressing the '*' key. The top row of keys represents the sharps and flats corresponding to this second keyboard. When you have mastered the keyboard, you are well on your way to composing your own music. Read on.



At the beginning, the program waits for you to start the song. This is one of the few times when a pause doesn't count. Once you start playing, the computer keeps track of every note and its length and register exactly as you play it. Practice a little bit to get the feel of the keyboard. It is not as simple as a piano, especially with the letters on the keys distracting you from what the true note is. The white keys on the display have the actual name of the note printed over the keyboard name of the key to help keep you oriented.

After you start a song, you may discover that you didn't mean to play a particular note. Fortunately there is a mistake-recovery method. As soon as you realize that you have made an error (sometimes the first note is an error), press the space bar to pause momentarily. You will be presented with several options.

1. CONTINUE allows you to start playing the song at exactly the point where you stopped. This is a useful technique for the times when you become confused as to which note you want to play next; press the space bar to pause, regather your wits, and press 'C' for continue, continuing from where you stopped.
2. REPLAY will play the song up through the current note so that you can inspect your masterpiece as you input and make corrections if necessary. This option can be chosen as many times as you need it.
3. BACKUP is the option for which you've been waiting. This allows you to remove one note at a time from the current song, all the way back to the beginning, if you want. When you make a mistake and press the space bar to pause, press the 'B' option and the note you are erasing will sound. Another 'B' will erase the next note, and so on. Then pressing 'C' will allow you to continue your song from the point to which you have backed up.

If, no matter how hard you try, you can't seem to get the song perfect, then the next step is to use the 'SONG EDITOR' program. This program is described in detail later in the article.

Other Menu Options

There are five additional menu options that allow you to hear your song, load a song from or save a song to the tape player, change the tempo of the song, or quit.

Choosing option number two, 'REPLAY SONG', will play the song currently in memory over the television speaker. The routine uses the current tempo for the speed at which to play the song. If there are no notes in the song, then 'NO SONG IN MEMORY' is printed and you are returned to the menu.

The 'SAVE' and 'LOAD' options are numbered three and four, respectively. To save the current song, choose '3' and answer the 'WHAT IS THE NAME OF THE SONG?' question with the name that you want to call the song. After you press

< return > you are prompted to press RECORD and PLAY on the tape player. When the song is saved, you are returned to the menu and the tape player will stop. If there are no notes in the song, you will be so informed and returned to the menu.

Option number four is similar in operation to option number three. Remember that when you LOAD a new song, you will erase any song currently in memory; you must SAVE the current song (if you want to keep it for later use) before loading a new one. The 'WHAT IS THE NAME OF THE SONG?' prompt will appear. If you don't know the name of the song, or you want the next song on the tape, press < return > and the next song will be loaded. If you have several songs on the tape, type the specific name of the song you want and the VIC will search through the tape until it finds the correct song. If the song isn't on the tape, you will have to press the RUN/STOP key to recover.

To change the current tempo setting, choose option five. The minimum (fastest) setting allowed is '1'. There is no restriction on the maximum (slowest) setting, except the limits of the VIC. However, a setting of over one hundred will result in extremely long notes.

When you are finished with VIC PLAYER and want to return to BASIC, choose option six. Always remember to save any song that you are currently working on before choosing this option. If you forget this rule, typing 'GOTO20' might enable you to return to the program without losing your song.

The Program

The VIC Player program contains six major functions, which are selected from a menu, three minor functions used during the playing of a song from the keyboard, and some support subroutines.

The main program (lines 10-50) calls subroutines to initialize program, turn off the sound generators, and print the menu on the display. It waits for a character in the range of the menu (1 to 6) then goes to the appropriate subroutine to service the selected function.

The PLAY SONG subroutine (lines 1000-1120) calls a subroutine to print the music keyboard, gets input from the keyboard, calls a subroutine to pack information about the current note and store it in memory, and then, depending on which key you press, will do one of the following things:

Space goes to the 'Continue, Replay, Back Up' subroutine;

Cursor Up or *Cursor Right* terminates the song by putting a 0 in the next song location and returning to the main menu;

'f7', 'f5', or 'f3' sets the register number and the current sound register pointer, calls a subroutine to turn off all sound registers, and continues in the



PLAY SONG routine:

An *undefined key* is converted to a 'musical rest'; and,

A *defined key* (i.e., a 'music key') is converted to its sound generator.

The REPLAY SONG subroutine (lines 2000-2070) prints the message 'PLAYING' and the song title, if there is one. If there is no song in memory, it prints the message 'NO SONG IN MEMORY', goes to a subroutine that produces a delay to enable the message to be read, and then returns to the main program.

If there is a song in memory, REPLAY calls a subroutine to unpack the register number, note pointer value, and duration for the next note from the song table. It uses a subroutine to output the note to the sound generator for the specified duration. The sound generator is then turned off and the song pointer incremented to the next note. If the maximum song length has been exceeded, then a return is made to the main program; otherwise the keyboard is checked and if any key is pressed a return is made to the main program.

If no key is pressed, the next note of the song is unpacked and tested. If it is not the 'end of song' indicator (a zero value) the program continues playing the song. At the end of the song, REPLAY uses a subroutine to generate a brief delay and then goes to the main program.

The SAVE SONG subroutine (lines 3000-3030) uses a subroutine to print the message 'WHAT IS THE NAME OF THE SONG?' and inputs a song name. It opens the cassette device for saving information and outputs the song information one note at a time. When it detects the zero note that signals the end of the song it closes the cassette device, prints the message 'SAVED', and exits through the delay routine.

The LOAD SONG subroutine (lines 4000-4030) uses a subroutine to print the message 'WHAT IS THE NAME OF THE SONG?' and inputs a song name. It opens the cassette device for loading information and inputs the song information one note at a time. When it detects an empty note it closes the cassette device, prints the message 'LOADED', and exits through the delay routine.

The CHANGE TEMPO subroutine [lines 5000-5020] prints the current value of the tempo

(continued)

VIC Player Listing

```

10 POKE36879,27:GOSUB12000
20 GOSUB9500:GOSUB10000
30 GETR$:IFR$=""THEN20
40 V=VAL(R$):IFV<10THEN50:IFV>60THEN30
50 ONV:GOSUB10000,2000,3000,4000,5000,6000:GOT020
1000 V=0:F=0
1010 GOSUB11000:PEM PRINT KEYBOARD
1020 D=0
1030 GETR$:D=D+1:IFR$=""THEN1030
1040 IFF=1THEN1050
1045 GOSUB9700:POKECR,0
1050 F=0:IFR$="" THENGOSUB8000:GOT01010
1055 IFR$="B"THENR$="M"THENPOKECR,0:W:(V+1)=0:RETURN
1070 F=ASC(R$)
1080 IFTR=133ANDTC=127THENR=136-TP:CR=R+RG:GOSUB9500:F=1
:GOT01020
1090 NX=TP-42:IFN>50THEN NX=3
1100 NP=NP+1:NX:POKECR,CR$NP
1110 V=V+1:IFV=LTHENEND:V)=0:RETURN
1120 GOT01020
2000 PPINT"PLAYING":PRINTB$:V=1
2010 IFW>V=0THENPPINT"NO SONG IN MEMORY":GOT09000
2020 GOSUB93200
2030 GOSUB93000
2040 POKECR,0:V=V+1:(FV=LTHENRETURN
2050 GETR$:IFR$=""THENRETURN
2060 GOSUB9200:IFSC=0THEN2030
2070 GOT09000
3000 GOSUB8100:OPEN1,1,1,B$:PRINT#1,B$,CR$:
3010 PPINT#1,W$;V$:CR$:
3020 IFW>V=0THENCLOSE1:PRINT"SAVED":GOT09000
3030 V=V+1:GOT03010
4000 GOSUB9100:OPEN1,1,0,B$:INPUT#1,B$:PRINTB$:
4010 INPUT#1,W$:V$
4020 IFW>V=0:THEN CLOSE1:PRINT"LOADED":GOT09000
4030 V=V+1:GOT04010
5000 PRINT"TEMPO":;
5010 PRINT"NEW TEMPO":;INPUTS:IFSC1THEN5010
5020 RETURN
6000 PPINT"END":END
6000 GOSUB9500:GOSUB9200
2010 PPINT"WHATCHOICES?:""
6020 PPINT"CONTINUE"?
6030 PPINT"REPLAY"?
6040 PPINT"RECALL UP 1 NOTE"?
6050 PPINT"WHICH??"?
6060 GETR$:IFR$=""THEN6060
6070 IFR$="C"THEN V=V-1:GOSUB9200:GOT09500
6080 IFR$="R" THENGOSUB2000:GOT08010
6090 IFR$="B" THENGOSUB60
6100 IFV<0:GOT08000
6110 V=V-1:GOSUB9200:GOSUB9800
6120 GOSUB9500:GOT08060
3000 FORI=1TO790:NEXT:RETURN
9100 PPINT"WHAT IS THE NAME":PRINT"OF THE SONG"?

```

(continued)

PERRY PERIPHERALS REPAIRS KIMs!!

(SYMs AND AIMs Too)

- We will Diagnose, Repair, and Completely Test your Single Board Computer
- We Socket all replaced Integrated Circuits
- You receive a 30-day Parts and Labor Warranty
- Your repaired S.B.C. returned via U.P.S. — C.O.D., Cash

Don't delay! Send us your S.B.C. for repair today
Ship To: (Preferably via U.P.S.)

PERRY PERIPHERALS

6 Brookhaven Drive
Rocky Point, NY 11778

KIM-1 REPLACEMENT Modules

- Exact replacement for MOS/Commodore KIM-1 S.B.C.
- Original KIM-1 firmware — 1K and 4K RAM versions

REPLACEMENT KIM-1 Keyboards

- Identical to those on early KIMs — SST switch in top right corner
- Easily installed in later model KIMs

Perry Peripherals is an authorized HDE factory service center.

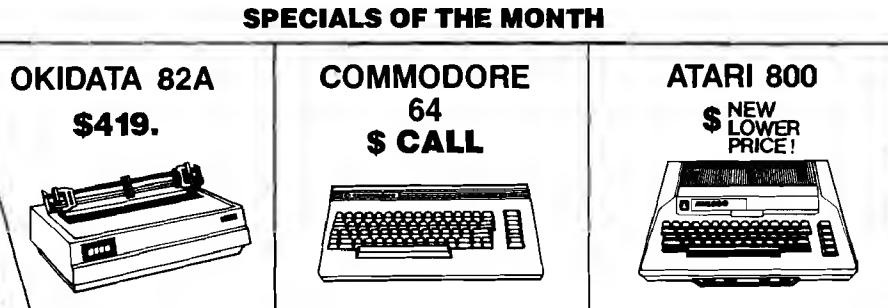
Perry Peripherals carries a full line of the acclaimed HDE expansion components for you KIM, SYM, and AIM, including RAM boards, Disk Systems, and Software like HDE Disk BASIC V1.1. Yes, we also have diskettes. For more information write to: P.O Box 924, Miller Place, NY 11764, or Phone (516) 744-6462.

Circle No. 47

WE TOOK
A BIG
BYTE
OUT OF
COMPUTER
PRICING!

ORDERING INFO

We accept Visa, Mastercard, Money Orders or Certified Check. Personal checks require 2 weeks for bank clearance. All items factory fresh & carry manufacturer's warranty. Prices subject to change without notice.



COMPUTERS

ATARI 400.....	\$197.
ATARI 800.....	\$598.
ATARI 410.....	\$74.
ATARI 810.....	\$439.
COMMODORE 64.....	CALL
COMMODORE VIC 20.....	\$149.
COMMODORE VIC 1530.....	\$69.
NEC PC 8001A.....	\$739.
NEC PC 8012A.....	\$499.
NEC PC 8031A.....	\$739.
SANYO MCB 1000.....	\$1599.
TIMEX 1000.....	\$84.
XEROX 5 1/4".....	CALL
XEROX 8".....	CALL
XEROX 630.....	CALL

PRINTERS

DIABLO 620.....	\$1199.
DIABLO 630.....	\$1675.
OKIDATA 82A.....	\$419.
OKIDATA 83A.....	\$699.
OKIDATA 84P.....	\$1029.
EPSON.....	CALL
NEC 8023.....	\$479.

SOFTWARE

MICROSOFT.....	CALL
MICROPRO.....	CALL
ALL MAJOR BRANDS.....	CALL

COMPUWAY, INC.

24 LUMBER ROAD

ROSLYN, N.Y. 11576

toll free **800 645 1362**
516 621 1362



variable, then requests and inputs a new value. If the value is less than 1, it is ignored. When a valid value is input, the routine returns to the main program.

The QUIT routine (line 6000) clears the screen and executes an END to return to BASIC.

The PLAY SONG MENU routine (lines 8000-8120) provides three additional commands for use while playing a song. When called by pressing the space bar, it first uses a subroutine to turn off all sound generators and another to unpack the current note. It prints its own menu and waits for a keyboard selection. On receipt of a 'C' it backs up the song pointer to the current note, unpacks the note, and turns off the sound generators before returning to the PLAY SONG routine.

The letter 'R' calls the REPLAY SONG subroutine, which plays the current song from the beginning to the current note, and then waits for another menu selection.

The letter 'B' causes the song note pointer to back up one position, unless it is already at the start of the song, and then go to the subroutines to unpack the note's values, output the note for the correct duration, turn off the sound generators when the note is done, and wait for another menu selection.

The support subroutines (lines 9000-13020) provide support for the main program and major subroutines.

Line 9000 provides a several-second delay to permit you to view messages.

Line 9100 prints 'WHAT IS THE NAME OF THE SONG?' and accepts a name from the keyboard.

Line 9200 unpacks the stored note information into its three components: the song register 'R', the note pointer 'NP', and the duration of the note 'D'. It also sets the correct song register and looks up the actual note from the note table. See 'packing information' in the section headed "Numeric Variables."

Line 9500 turns all three song registers off by setting them to 0.

Line 9700 makes sure that the note duration is not greater than 99 and packs the three components of the note (the song register 'R', the note pointer 'NP', and the duration of the note 'D') into a single integer value in the song array. See 'packing information' under the heading "Numeric Variables."

Line 9800 outputs a note by placing its value in the current sound generator. It waits for the duration of the note, which is calculated as the tempo 'S' times the note duration 'D' divided by 8, times the length of the BASIC FOR...NEXT loop.

Line 10000 prints the main menu.

Line 11000 prints the keyboard display.

Line 12000 performs a series of initialization functions. It sets the tempo 'S' to 50 and the length of the song 'L' to 260 notes; it dimensions three integer arrays — (W%[L]) to hold the song note information, and A%[38] and NP%[50],

which associate the keyboard characters with the notes; it turns off all three sound generators and sets the sound volume to its maximum value of 15; it restores the DATA statement pointer and reads the DATA into the A%[I] array and the NP%[I] array; and it sets the middle sound register as the current register and returns to the main program.

Line 13000 contains the data for the values of each of the notes (three octaves plus two notes, C through C#). The zero at the end is the entry for a rest. These values correspond to the values in the VIC programming manual. Note that they vary slightly from the values in the VIC reference manual.

Line 14000: This data table has the pointers for the keyboard playing routine. Since the keyboard is not in note order and the note table values are in note order, it is necessary to convert from the keyboard code to the position in the note table. For example, 'Z', which is a 'C', has the keycode 90. This number is called the ASCII value and is a standard form of encoding the keys for a computer. Line 1090 subtracts 42 from 90, resulting in 48 as the keyboard position. (The first 42 keycodes are unused, and so we throw them away.) If you look at the table of pointers, you will see that the 48th entry is '0'. Therefore, the note pointer for Z is 0. If you look at the note table data, you will see that the zeroth (first) entry in this table is 135. This is the value to be POKEd to make the sound 'C'.

Programming Concepts

Using a Menu to Make a Choice

1. Selecting by Number

When you run the PLAYER program, the first display that you see is a list (or menu) that tells you what actions are available. Each item on the menu is selected by pressing the number associated with it. The BASIC program steps required to make the choice are in lines 40 and 50.

```
40 V = VAL(A$): IF V < 10 OR V > 6 THEN 30
50 ON V GOSUB 1000,2000,3000,4000,5000,6000:
      GOTO 20
```

Line 40 converts the keyboard character in A\$ to its numeric value in variable V. If V is less than 1 or greater than 6, then the number is ignored and the program returns to line 30 to get another choice from the keyboard.

Line 50 uses ON V GOSUB to go to the subroutine whose position matches the number: the first subroutine address for a 1 (subroutine 1000), the second subroutine address for a 2 (subroutine 2000), and so forth for numeric values of 1 through 6.

2. Selecting by First Letter

If the space bar is pressed during the 'PLAY SONG', then another menu is displayed.

(continued)

YOU
CAN MAKE
A FORTUNE
IN MICROS!

THE MICRO COMPUTER BUSINESS WILL GROW FROM \$10 TO \$100 BILLION IN THE NEXT EIGHT YEARS! ARE YOU READY TO CASH IN?

The micro computer business is predicted to grow from its present \$10 billion to \$100 billion before 1990! Imagine the possibilities this opens for you! No matter where you live, if you're starting up or presently in business, no other industry offers you more opportunities!

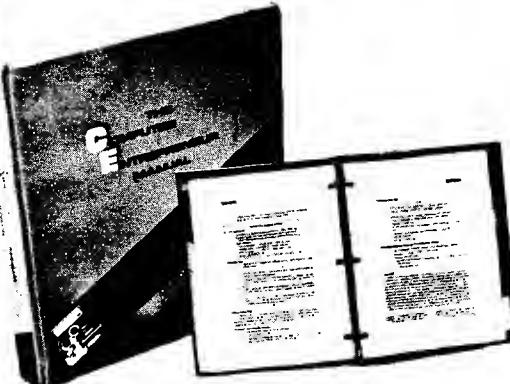
Now, finally, all the inside information you need to secure a prosperous future in this dynamic industry is available in one place - THE COMPUTER ENTREPRENEUR MANUAL! - An immense information source, compiled by our inquisitive research team, aided by a panel of experts and business people from all areas of the computer industry!

We present the inside story of more than 100 lucrative computer businesses you can enter, where you'll find the real opportunities for the eighties: from one man operations like Programming Author, Word Processing Center or Consulting, to Systems House, Service Bureau, Computer Store etc! Many at little or no investment! All the invaluable facts and figures: How to start, Capital needs, Profit estimates and Margins, How to Sell and Market, How missing technical or business experience need not stand in your way, Source of Suppliers, etc! Details that could take years to find out on your own!

We'll show you inside tricks, like how to never again pay retail for computer products and consumer electronics, even for one item - right now, while you're starting your business! How to get free merchandise and trade show invitations, etc. This alone will more than pay for the manual! You'll read actual case histories of other computer entrepreneurs, so you can learn from their mistakes, and profit from their success stories! Where you'll be one year from now depends on your actions today! Let us show you how to take the first crucial steps!

Order now and take advantage of our limited introduction special, THE COMPUTER ENTREPRENEUR MANUAL, and a six month subscription to THE COMPUTER ENTREPRENEUR REPORT/NEWSLETTER (so you're always up-to-date with the industry), both for only \$29.95! You must be convinced on how easy you can strike it rich in the micro computer business - or you may return the manual for a full refund within thirty days! USE OUR TOLL FREE NUMBER TO ORDER!

EVERYTHING YOU NEED TO KNOW TO SUCCEED IN THE COMPUTER BUSINESS IS ALL IN THIS MANUAL!



Bartering, Mail Order, Compile and rent mailing lists, Specialized Data Headhunting and Temp Help Service, Tech Writer Shop, Custom Engineering, The highly profitable Seminars and Training Business, and many more!

Many new ideas and ground floor opportunities! Interviews and success stories on companies of all sizes! Privy info on the profits made: How some computer store operators net \$100 - \$250,000! Little known outfits that made their owners millionaires, one of these low-key companies, making simple boards, went from nil to \$20,000,000 and 100 employees in four years! Programmers that make \$300,000, Thousands of micro millionaires in the making, etc!

Whatever your goal is - Silicon Valley Tycoon, or just a business at home - we guarantee you'll find a business to suit you - or your money back!

PART TWO of the manual is loaded with the know-how and "streetfighting" savvy you need, both as a novice or business veteran, to get started, to stay and to prosper in the micro computer business! A goldmine of information in clear and easy-to-use instructions: How to prepare your Business Plan, Outside financing, The mistakes you must avoid, How to hire and manage employees, Incorporation (when, and how to do it cheaply), Surviving bad times, Record Keeping, how to estimate your market before you start, Use multiple locations to maximize profits, how to promote and stay steps ahead of the competition! How to get free advertising, free merchandise, free advice, Power negotiating with suppliers to double your profit margins, etc! Even how to keep a present job while starting a business part time!

Don't miss this opportunity to be part of this great industry - the next success story could be your own! Order the manual today! Part one and two, bound in a deluxe ring binder, where you can also collect our newsletter (free for six months with the manual - a \$32.50 value!) - all for only \$29.95!



THE COMPUTER ENTREPRENEUR NEWSLETTER - ALL THE LATEST INSIDE BUSINESS NEWS! NOW! SIX MONTHS FREE WITH YOUR MANUAL!

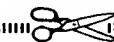
You're always attuned to the industry, and your manual kept up-to-date, with our newsletter! Each issue has the latest business news, ideas, new suppliers, our indispensable "watchdog" column on profits, discounts (don't miss mfg. promos, like recently, when top video monitor sold at \$80 - that's half wholesale, one third of the retail price!), the competition, the big deals, etc! Feature stories with start-up info and case histories on new micro businesses!

You'll get invitations to trade shows and conventions, the usage of our advisory service and our discount buying service for your purchases!

You'll find many items in our newsletter that will save you the cost of your manual many times over! © 1982, THE COMPUTER ENTREPRENEUR



Order by phone (Credit cards only), or use the coupon:



Mail to THE COMPUTER ENTREPRENEUR PUBLISHING CO.
PO BOX 458, Grand Central Station, New York, N.Y. 10163
Please send me THE COMPUTER ENTREPRENEUR
MANUAL, and the six month free subscription to
THE COMPUTER ENTREPRENEUR REPORT/NEWSLETTER.
All for only \$29.95, plus \$3 for postage/handling (NY residents: add \$2.64 for sales tax). If I decide not to keep the
manual, I may return it within 30 days for a full refund.

NAME: _____

ADDRESS: _____

CITY, STATE, ZIP: _____

Check or M.O. enclosed Charge to VISA MC

CARD #: _____

Exp. Date: _____

SIGNATURE: _____

MM0683



The first character of each item is displayed in reversed video to indicate that the letter is to be pressed on the keyboard to select that choice. Each letter is serviced by its own IF...THEN statement.

CHOICES:
CONTINUE
REPLAY
BACK UP 1 NOTE
WHICH?

```
8070 IFA$ = "C"THEN V = V - 1 :GOSUB9200:  
      GOTO9500  
8080 IFA$ = "R"THEN GOSUB2000:GOTO8010  
8090 IFA$ < > "B"THEN8060
```

If there are only a few choices, as in this example, that is not a lot of code. If there were many choices, then the amount of code to service the letters could be significant.

Numeric Variables

VIC BASIC handles two kinds of numbers — integer and floating point. An integer number is a number without a decimal (123,9999,0,-4387 and so forth). A floating-point number has a decimal point (12.34, 98765.1, 0.0, -435.678 and so forth). Often it does not matter which type of number is being used, but it can make a significant difference in some programs.

Integers

An integer number in the VIC may be as large as +32767 or -32768. Each integer number that the program stores requires two bytes of memory. An unexpanded VIC has only about 5000 bytes of user memory, so the number of bytes available is limited. Most BASICs identify which information is stored in integer form by using a % after the one- or two-character symbol name. Examples in VIC PLAYER are F1%, F2%, T%, W%, and A%. In VIC PLAYER, W% and A% are arrays — a large number of related values with a common reference. W%, for example, is the memory reserved to save the note, register, and duration of each note of the song. To allow enough memory for a reasonably long song, we found it necessary to perform a few tricks. First, let's examine how not to program the storage area.

Each note of the song that you play produces three pieces of information that must be saved by VIC PLAYER:

the register of the note

the number of the note

the duration of the note

We could define a two-dimensional array that contains a floating-point number for each of the three parts of each note: DIM W(299,2) would reserve space for 300 notes, three floating-point numbers per note. How much memory do you think this would take? Well, 300 times 3 is 900. Is that the total number of bytes required? No! Each floating-point number requires five (5) bytes of memory. Therefore, it would take 5 * 900 or 4500 bytes of memory! There is barely enough space in your basic VIC for the song, and that's not counting the space required for the program itself.

One obvious way to save space would be to store the three parts of each note as integer values instead of floating-point values. Since each integer value requires only two (2) bytes of memory for storage, the total requirement for the 300-byte song would be 2 * 900 or 1800 bytes. That is better, but it still uses almost half of the memory in your basic VIC, which does not leave much room for the program.

You have to get a bit tricky to squeeze much more out of the song space; but there is nothing wrong with getting tricky when writing programs. In fact, that can be half the fun! To really squeeze the memory in VIC PLAYER we took advantage of the size of the number that a single integer value might hold. An integer requires two (2) bytes of memory, whether it contains 0, 32335, -32334, or whatever. The three values that we need to keep for each note played are: the register number (1, 2 or 3); the note number (0 to 38); and the duration (which is limited to 0 to 99 units). If only we could pack all three of these individual values into a single integer number for storage and then unpack them when we needed to use them. Well, good news — we can!

The technique to pack the numbers is shown in line 9710.

$$9710 W\%(V) = INT(R * 10000 + NP * 100 + D)$$

This equation is not as difficult as it may at first appear.

W\%(V) is the address of the integer where V is the number of the note in the song;

INT is the BASIC function that converts a floating point (five bytes, remember) into an integer number (only two bytes);

R * 10000 multiplies the register value (1 to 3) by 10000;

+ NP * 100 multiplies the note number (0 to 38) by 100;

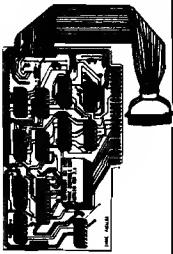
+ D adds the duration value (0 to 99).

(continued)

APPLE HARDWARE

THE TACKLER™ — DUAL • MODE PARALLEL INTERFACE FOR THE APPLE® 2 BOARDS IN ONE FOR NO MORE COMPATIBILITY PROBLEMS!

An intelligent board to provide easy control of your printer's full potential. Plus a standard parallel board at the flip of a switch — your assurance of compatibility with essentially all software for the APPLE®. Hires printing with simple keyboard commands that replace hard to use software routines. No disks to load. Special features include inverse, doubled, and rotated graphics and many text control features, available through easy keyboard or software commands. Uses industry standard graphics commands. This is the first truly universal intelligent parallel interface! Change printers — no need to buy another board. Just plug in one of our ROM'S and you're all set. ROM'S available for Epson, C. Itoh, NEC, and Okidata — others available soon. Specify printer when ordering. Call for Price.

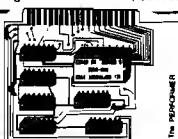


THE UPGRADEABLE PPC-100 PARALLEL PRINTER CARD

A Universal Centronics type parallel printer board complete with cable and connector. This unique board allows you to turn on and off the high bit so that you can access additional features in many printers. Easily upgradeable to a fully intelligent printer board with graphics and text dumps. Use with EPSON, C. ITOH, ANADEX, STAR-WRITER, NEC, OKI and others with standard Centronics configuration. \$139.00

IF YOU WANT GRAPHICS AND FORMATTING THEN CHOOSE THE PERFORMER

for Epson, OKI, NEC 8023, C. ITOH 8510 provides resident HIRES screen dump and print formatting in firmware. Plugs into Apple slot and easy access to all printer fonts through menu with PRM command. Use with standard printer cards to add intelligence. \$49.00 specify printer.



THE MIRROR FIRMWARE FOR NOVATION APPLE CAT II®

The Data Communication Handler ROM Emulates syntax of an other popular Apple Modem product with improvements. Plugs directly on Apple CAT II Board. Supports Videx and Smarterm 80 column cards, touch tone and rotary dial, remote terminal, voice toggle, easy printer access and much more. List \$39.00 Introductory Price \$29.00

MINI ROM BOARDS

Place your 2K program on our Mini Rom Board. Room for one 2716 EPROM. Use in any slot but zero. Only \$34.95

Circle No. 50

DOUBLE DOS Plus

A piggy-back board that plugs into the disk-controller card so that you can switch select between DOS 3.2 and DOS 3.3. DOUBLE DOS Plus requires APPLE DOS ROMS. \$39.00

SOFTWARE



Super Pix

Hires screendump software for the Epson, OKI, C. Itoh and Nec 8023. Use with Tymac PPC-100. Special \$19.95 (Specify Printer)

Mr. Lister — Customer Contact Profiler & Mailer

A Super Mail List Plus more — up to 1000 Entries on single 3.3 Disk (only 1 Drive required) — 2 second access time to any name — full sort capabilities — Dual Index Modes — supports new 9 digit Zip. Easy to follow manual — Not Copy Protected — 4 user defined tables with 26 sort selections per table — Beta tested for 6 months — user defined label generation. Introductory Price \$135.

\$99.00 Dealer & Dist. Inquiries Invited.

APPLE LINK

A communications system for the Apple® (Requires Hayes Micro Modem). Transmit and receive any type of file between APPLES®, Automatic multi-file transfer, real time clock indicating file transfer time. Complete error check. Plus conversation mode. Only one package needed for full transfers. Compatible with all DOS file types. (requires Hayes Micro Modem) \$59.00

THE APPLE CARD/ATARI CARD

Two sided 100% plastic reference card Loaded with information of interest to all Apple and Atari owners. \$3.98

NIBBLES AWAY II

AGAIN! Ahead of all others.

- **AUTO-LOAD PARAMETERS** . . . Free's the user from having to Manually Key in Param values used with the more popular software packages available for the Apple II.
- **EXPANDED USER MANUAL** . . . incorporates new Tutorials for all levels of expertise; Beginners Flowchart for 'where do I begin' to 'Advanced Disk Analysis' is included.
- **TRACK/SECTOR EDITOR** . . . An all new Track/Sector Editor, including the following features: Read, Write, Insert, Delete Search, and impressive Print capabilities!
- **DISK DIAGNOSTICS** . . . Checks such things as: Drive Speed, Diskette Media Reliability, and Erasing Diskettes.
- **HIGHEST RATED** . . . Best back up Program in Softalk Poll (Rated 8.25 out of 10)
- **CONTINUAL UPDATES** . . . Available from Computer Applications and new releases on the source. \$69.95

Dealer and Distributor Inquiries Invited.

MICRO-WARE DIST. INC.
P.O. BOX 113 POMPTON PLAINS, N.J. 07444

201-838-9027

VIC-20*

SOFTWARE SPECIALS

CBM-64*

NEW! CARTRIDGE GAMES FROM TRONIX

SCORPION \$34.95

Full 4-way scrolling, fast action predator game where it's you against killer frogs, slimy worms, stalker flies, dragons and hatchet pods. With 32 levels of play

GOLD FEVER .. \$29.95

Explore a deadly mine searching for valuable gold deposits. Avoid roaming mine carts, rolling boulders and a crazy claim jumper! With 9 levels of play

DEADLY SKIES \$29.95

Frenetic, fast paced action-packed game where you are the Rebel fighter attacking the hostile military base. Avoid S.A.M.s, smart bombs and deadly radioactive clouds! Over 10 levels of play

From Interesting Software
Cassette \$15.95

ALL
MACHINE
CODE'



Bring the fun of the shooting gallery into your home. With music and colorful graphics

CBM-64 & VIC-20 MINI-MONITOR

All machine code monitor which will disassemble code, do text dump, move memory, hex to decimal and decimal to hex conversion as well as a mini-assembler!

VIC-20 version requires 8K expansion.

Cassette \$24.95
Disk \$29.95

CREATIVE SOFTWARE GAMES ON CARTRIDGE

CHOPLIFTER	\$39.95
SERPENTINE	\$39.95
APPLE PANIC	\$39.95
ASTROBLITZ	\$39.95
TRASHMAN	\$39.95

Stellar Triumph

Great new al' machine code game for your CBM-64. One or two player game with all the arcade sound and graphics! Fantastic space war game with many options

From H A L Labs tape or disk \$24.95

Dust Covers

Water resistant
Attractive brown canvas \$7.95

KIDS & THE VIC

Great new book to add to your library.
only \$14.95

INTERESTING SOFTWARE

2100 S. Harvard Blvd. Torrance, CA 90501

1213-326-9422

VISA MC DISC MASTERCARD ADD \$2.00 Handling & Handling CA residents add 7% sales tax Dealer Inquiries Invited

At Last! Two new ways to expand the usefulness of your Rockwell AIM or Cubit CPU computer are available for immediate, off-the-shelf delivery.

To discover how two new, state-of-the-art circuit cards from Design Dynamics can expand the use you get from your AIM or Cubit computer by providing bus compatible Analog to Digital Interface and Full Color Graphics, please read on.

Until now, if you needed a complete Analog to Digital Interface or Full Color Graphics display for your AIM or Cubit computer, you had to design and build it yourself.

But today, Design Dynamics fills each need on 4½" x 6½" cards. Just look at the features packed into each card:

A total control interface

The AIM/Cubit-compatible interface has been designed to provide you with a flexible, total control interface which includes A to D functions, D to A functions, a clock with user ports section and a User Prototyping Area. Circuit Card with all functions, \$1,100.

Boards with selected functions

Analog to digital input is handled on 16 channels with 12 bit resolution. Maximum conversion time is 35 μ sec. per channel. Card with only A to D function, \$375.

Digital to analog output provides control of 0 to 10 Volts. 8 μ sec. conversion is provided by double-buffered, 4 channel, 12 bit D/A converters. Card with only D to A function, \$675.

A 24-hour time of day clock, with independent crystal time-base, includes an alarm mode for scheduling events. Two 16 bit timers, each with 16 bit prescaler and start/stop control can count multiple source pulses.

And, a User Prototyping Area provides power, ground bus and grid area for custom signal conditioning. Clock with Prototyping Area Card, \$275.

Start-up software for each circuit card is provided.

Full Color Graphics

Now you can expand your system display from limited alphanumeric to a full color CRT display which includes two graphic modes, multicolor mode and text mode, viewed on your own color CRT.

Design Dynamics Full Color Graphics uses no system RAM, and includes its own 16K dynamic RAM memory. It provides 35 planes of vertically stacked display, 32 sprites in front of graphic plane and internal anti-collision management.

Graphics I provides pattern graphics in 15 colors, 256 x 192 pixels; while Graphics II offers more complex colors and patterns. The Multicolor mode displays in positions of 64 x 48, with four colors per 8 x 8 pattern. The Text mode pattern plane is broken into 40 x 24 positions for text-only display. Full Color Graphics Card, \$175.

Startup software included assists the user in becoming familiar with the extensive capacities of this board.

Full documentation included

A Data Pack which includes full documentation for each board makes it simple to put the A to D Interface and Full-Color Graphics to immediate use. Or, if you need to be sure these boards will fit your applications, you may order the Data Pack separately for only \$15 per card.

Motherboard available

A fully buffered Motherboard for system expansion of eight cards allows convenient placement of boards for prototyping. Expansion Motherboard is \$175.

Save time, money; call today

Get these AIM and CUBIT function-expanding cards *right now*, or call Jack Schnabel for complete information.

DESIGN DYNAMICS

1830 Soscol Avenue • Napa, California 94559 • (707) 257-6000

Rockwell AIM is a trademark of Rockwell, International • Cubit CPU is a trademark of Cubit, Incorporated
Circle No. 52



VIC Player (continued)

All we have done is multiply two of the three parts that we need to save by enough to make sure they do not overlap. This insures that we will be able to unpack the separate parts later. The unpacking is a bit more difficult than the packing, but conceptually it is simple. All we need to do is reverse the packing process. This is accomplished in the following lines:

```
9200 X = W%(V)
9210 R = INT(X/10000):
  CR = RG + R
9220 Y = INT(X - R*10000)
9230 NP = INT(Y/100)
9240 D = INT(Y - NP*100)
9250 N = A%(NP):
  RETURN
```

Line 9200 simply copies the packed value of the note into X.

Line 9210 restores the register number by dividing the packed value by 10000, reversing the original saving process. It also sets the current register (CR) to the new register number.

Line 9220 restores the note number and duration combined value that was 'thrown away' in the previous step.

Line 9230 restores the note number by dividing by 100.

Line 9240 restores the duration by subtracting the note number component.

Line 9250 restores the value of the note by looking it up in the note table, A%(X), using the calculated note pointer, NP.

The above lines of program have taken the single integer value and converted it back into three separate parts. The savings of this method result in a 300-note song requiring only 300 integer numbers to store it, at two bytes per number, for a total storage of 600 bytes. Quite a reduction from the original 4500 bytes!

MICRO

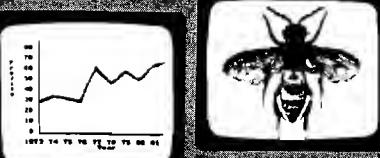
DRAW

with your JOYSTICK!



High resolution pictures
with print-out to VIC printer.

Put your hands on creativity with the **DRAW** program for the VIC or '64. Draw narrow or wide lines, curvy or straight, create background patterns, correct mistakes, set colors, add captions, zoom in for graphs and pie charts. **DRAW** your creations to tape or disk and print a high copy.



Program includes a large "picture library" ready to use as is or modify with joystick. Plotting program included for making perfect circles. On cassette.

'64 Panorama \$29.95
VIC-Pics \$29.95

Also available:
Smart ASCII, a software interface for parallel printers.
At \$59.95, lowest cost, most flexible interface for VIC and '64. On cassette, with 80 print formats.

Terminal 40 (40 step terminal)

Easy to use, 40 terminal lines.

'64 Terminal (same)

24 terminal lines.

Enjoy
DOS
label
parameters
super
standard
Super
program
cassette
need
software
Super

MIDWEST MICRO Inc.

ORDER DESK
(816) 333-7200

MAIL ORDER
1000 W. 12th Street
KANSAS CITY, MO 64114
1-800-333-7200

311 WEST 72nd ST. • KANSAS CITY, MO 64114

Circle No. 53

DISCOUNT COMPUTER SOFTWARE ACCESSORIES

APPLE



	Retail	Discount		Retail	Discount
Eliminator	\$29.95	21.00	Zork I	39.95	29.00
War	24.95	18.00	Zork II	39.95	29.00
Adventureland	29.95	21.00	Deadline	49.95	36.00
Pirates Adventure	29.95	21.00	Mastertype	39.95	29.00
Golden Voyage	29.95	21.00	Castle Wolfenstein	29.95	21.00
Magic Window	99.95	72.00	Supertext II	150.00	108.00
Temple of Apshai	39.95	29.00	Softcard Premium System	775.00	600.00
Upper Reaches of Apshai	19.95	15.00	Wizard and the Princess	32.95	24.00
Curse of Ra	19.95	15.00	Time Zone	99.95	72.00
Midway Campaign	16.00	12.00	Threshold	39.95	29.00
Hi-Res Computer Golf	29.95	21.00	Softporn Adventure	29.95	21.00
005 Boss	24.00	18.00	Crossfire	29.95	21.00
The Arcade Machine	44.95	33.00	Frogger	34.95	25.00
Star Blazer	31.95	23.00	Laff Pak	34.95	25.00
Choplifter	34.95	25.00	Ultima II	59.95	44.00
Serpentine	34.95	25.00	Screenwriter II	129.95	94.00
Deadly Secrets	34.95	25.00	Graphics Magician	59.95	44.00
Raster Blaster	29.95	21.00	Pie Man	29.95	21.00
Bug Attack	29.95	21.00	Fastgammon	24.95	18.00
The Home Accountant	74.95	54.00	Congo	34.95	25.00
Snack Attack	29.95	21.00	Goldrush	34.95	25.00
Pig Pen	29.95	21.00	Gorgon	39.95	29.00
Wordrace	24.95	18.00	Beer Run	29.95	21.00
Rendezvous	39.95	29.00	Snake Byte	29.95	21.00
Russki Duck	34.95	25.00			
Horizon V	34.95	25.00			
Sargon II	34.95	25.00			

Intec 32K Board \$75.00
APPLE Compatible Disk Drive \$265.00
VERBATIM/DATALIFE Disks \$26.00

SPECIAL OFFERS

MANY MORE PROGRAMS AVAILABLE

VISA AND MASTERCARD ACCEPTED

TERMS: Send check or money order for total purchase price, plus \$2.00 for shipping. MI residents add 4% tax. C.O.D. accepted.

© MFGS. TRADEMARK

STRÖM 
P.O. Box 197
Plymouth, Mi. 48170
(313) 455-8022

WRITE OR CALL FOR FREE CATALOG
PHONE ORDER HOURS
4 PM - 9 PM MON. - FRI.
INCLUDE CARD NUMBER
AND EXPIRATION DATE WITH
CREDIT CARD ORDERS.
INCLUDE TYPE OF COMPUTER.



An Inexpensive Lightpen for the VIC-20, C 64, and Atari

by David Bryson

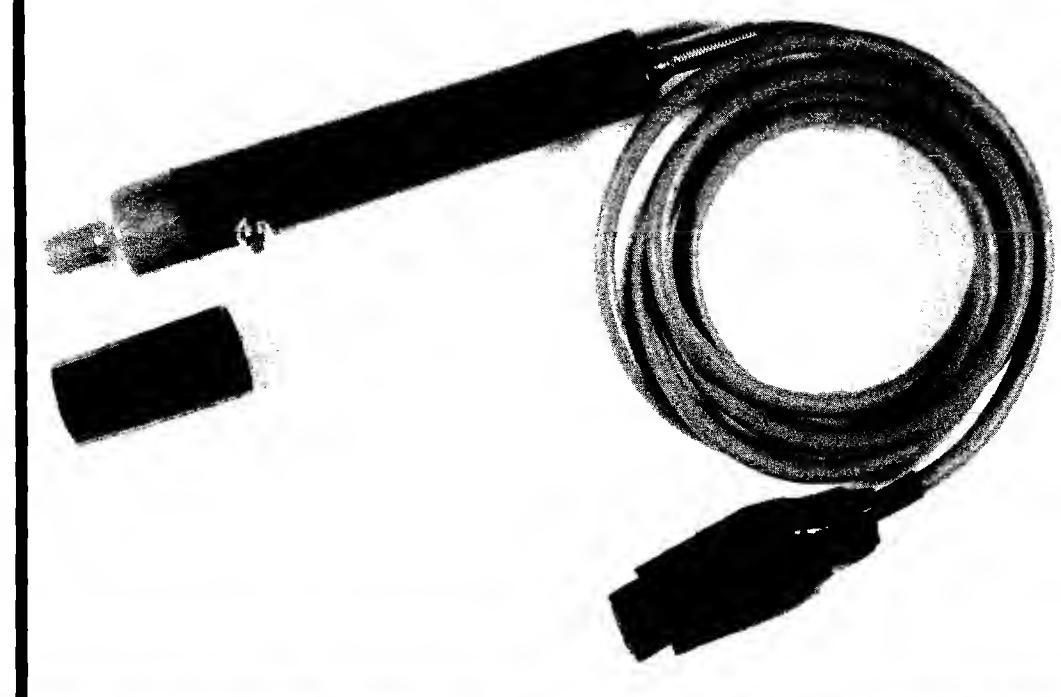
What is a light pen?

A light pen is a simple device that connects to your computer with a wire. With an appropriate program in memory, you can use your light pen for a wide variety of applications. Possibilities include drawing lines or more complicated pictures and selecting items displayed on the screen by simply pointing at them. For instance, you could have a questionnaire with a box displayed next to each possible answer. By pointing the light pen at the appropriate box and pressing the light pen's button you would select that answer. There is an endless variety of game applications.

A light pen works on a very simple principle. The tip contains a light-sensitive phototransistor that senses the light of a TV's beam. The VIC, VIC

II, and ANTIC chips included with VIC-20, Commodore 64, and Atari 400/800/1200 computers (as well as a number of other CRT controllers) continually keep track of the horizontal and vertical position of the TV beam. When the phototransistor detects the passing beam, it sends a signal to the CRT controller, and the current X,Y position is locked into registers that can be read by a program.

Both Commodore and Atari have light pens available. However, if you have very basic soldering and mechanical skills you can construct the inexpensive light pen described by David Bryson in this article. For further help with software, consult the references listed.



I hadn't found a light pen construction article for the VIC or Atari that produced suitable results, so I decided to design a light pen circuit that was both functional and completely compatible with hardware and software for both microcomputers.

VIC-20 Light Pen Basics

The VIC chip constantly monitors the location of the electron beam on the CRT screen and stores integer values for both coordinates in memory addresses 36870 (horizontal) and 36871 (vertical). With the light pen held in close proximity to the CRT screen, the phototransistor in the pen tip will produce a negative pulse as the beam passes over the pen tip. This negative pulse in turn latches the X and Y values being monitored by the VIC chip and stores the results in the appropriate memory address. This cycle is repeated for every frame produced by the CRT raster at a horizontal scan rate of 15,750 Hertz. If an accurate measurement of beam location is to be achieved at these frequencies, the optoelectronic device used as the light detector must be capable of a relatively high switching rate with rise and fall times in the unit microsecond range. The Motorola MRD300 phototransistor incorporated in this design has a typical switching time of two microseconds while maintaining a moderate light current sensitivity.

Light Pen Construction

You need the following parts for construction of the light pen circuit shown schematically in figure 1.

1. Phototransistor, Motorola type MRD300 or equivalent
2. Switch, subminiature SPST momentary contact. Radio Shack #275-1571 or equivalent
3. Resistor, 100Kohm, $\frac{1}{4}$ watt
4. Cable, 4 feet, 2 conductor stranded #24AWG with shield. Belden #9397-100 or equivalent
5. Connector, D-Subminiature manufactured by Robinson Nugent Inc. Available from:
Digi-Key Corp
Thief River Falls
MN 56701
Digi-Key #R700-ND or equivalent
6. Light Pen Main Housing (see text)
7. Jerk Relief Spring (optional)
8. Quick-setting Epoxy Devcon "5-minute" or equivalent

Obtain either a new or used felt-tip marking pen to serve as the light pen main housing. Use a brand with the large diameter body (about $\frac{3}{4}$ inch) to insure ample room for internal switch installation. Disassemble the pen by disconnecting the

removable head section; remove the fiber ink reservoir from the main body and the felt tip from the head section. Then clean remnant ink from both pen sections and from the marking pen cover. Save the cover for later use in protecting the delicate tip of the light pen during storage.

Secure the phototransistor in position within the tip assembly and bond to the inside surface with 5-minute epoxy. Use caution during this operation to prevent any glue spillage onto the phototransistor lens area. Note that the lens tip is flush with the tip of the barrel as shown in the pictorial section in figure 2. Drill holes through the barrel end and outside surface to accommodate installation of the cable and switch assemblies. Insert the cable through the hole in the barrel end (with the strain relief spring in place if used) and make the appropriate solder connections between switch, phototransistor, and cable.

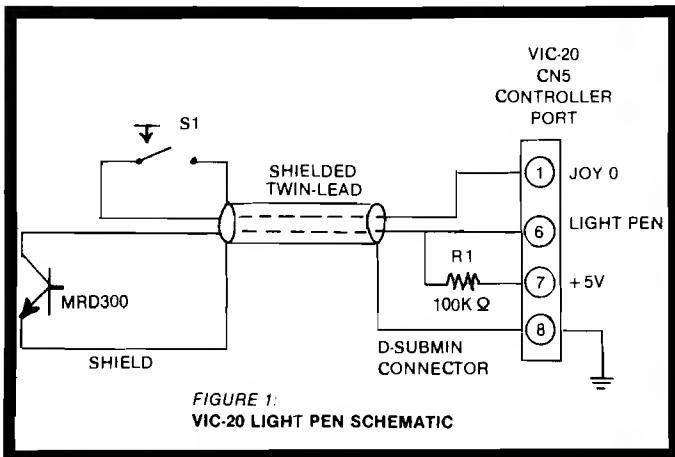


FIGURE 1:
VIC-20 LIGHT PEN SCHEMATIC

Secure the switch to the barrel assembly with the nut provided. Pour a small amount of 5-minute epoxy into the base assembly to secure the cable at the barrel and exit hole and connect the head assembly to the main body. In some felt tip pen designs, this will be a snap-on connection. Others will require a small amount of cement to secure the two pieces. If your design requires the adhesive, leave the bonding of the two pieces as the final step in pen construction in case problems arise during final test that require troubleshooting the internal barrel assembly.

Prepare the two conductors and shield at the cable end for connection to the D-Subminiature connector. If this type of connector is not readily available and if waiting the two weeks for mail order response is out of the question, consider the following options. If a used D-subminiature connector from an Atari joystick or paddle control is available, it can be used after performing razor blade surgery to relocate the internal pin receptacles to the positions needed for light pen connection. The process is not as difficult as it sounds. If carefully applied razor cuts are made along both

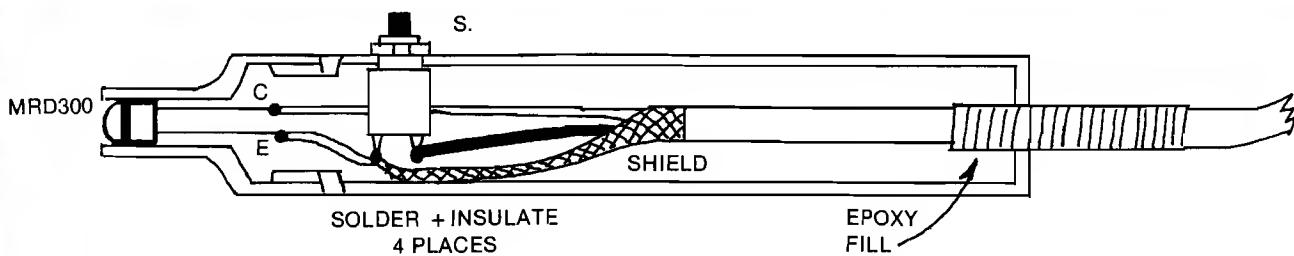


FIGURE 2: PICTORAL SECTION OF VIC-20 LIGHTPEN

edges of the connector, the internal halfs hinge open to allow access and switching of the pins. An easier but more expensive alternative is to purchase a Radio Shack D-Subminiature 25-pin female connector (#276-1565) and reshape the connector to fit the VIC receptacle by removing a 16-pin section of the plug body. If this operation is carefully performed, a second 9-pin D-Subminiature connector can be produced from the remnant 16-pin plug section.

Make the required solder connections between cable conductors and connector. Install and solder the 100K ohm resistor between pins 7 (+5V) and pin 6 (light pen) within the connector body. Secure and insulate the connector assembly with electrical tape if necessary.

A photograph of the assembled light pen is presented in figure 3.

Light Pen Application

Plug the completed light pen into the VIC and type in the following program:

```

10 X = PEEK(36870)
20 Y = PEEK(36871)
30 SW = -(PEEK(37151)AND4) = 0
40 PRINT"CLEAR"X;Y;SW
50 FORT = 1TO50:NEXT
60 GOTO10

```

The run should produce a group of three numbers displayed at the top left corner of the monitor screen. The left value is the contents of the X or horizontal register, the middle number is the contents of Y or vertical register, and the number on the right is either a 0 or a 1 depending on the state of the switch at the tip of the light pen. Note that some adjustment may be required to the brightness and/or contrast controls on the monitor to produce the desired results.

The expression in statement 30, SW = [(PEEK(37151)AND4) = 0], instructs the computer to

monitor the state of the port B output register to determine the position of the switch at the light pen tip. By using a compound statement such as

```

100 SW = -((PEEK(37151)AND4) = 0):IF SW = 0
THEN 100

```

the system can be put into a loop awaiting the activation of the light pen switch before proceeding with the next step in the program. One obvious advantage of this scheme is to reduce false input or "noise" caused by ambient light (other than from the CRT screen) producing a light pen signal. With this statement in the program, the pen location registers will only be examined when the switch is depressed. It is also possible to leave this statement out and provide real time screen position monitoring without switch activation, as evident in the six-line light-pen test program presented earlier.

Further Reading

1. Hale, William. "A Light Pen For Under \$10," *Compute!*, #27 (August, 1982), 141.
2. Loomis, Sumner S. "Let There Be Light Pens," *The Best of BYTE*, Vol. 1, 153-157.
3. Malmberg, David. "Using The VIC Joystick," *Home and Educational Computing*, Vol. 1, Issue 1, 18-24.
4. Malmberg, David. "VIC Light Pen-Manship," *MICRO*, #41 (October, 1981), 54-59.
5. Peck, Robert A. "Basics Of Light Pen Operation," *Compute!*, #10 (March, 1981), 36-41.

David Bryson is presently employed as a senior materials engineer-nondestructive testing-with the Pratt and Whitney Aircraft Commercial Engineering Division of United Technologies Corporation. You may contact the author at 9 Luster Lane, Enfield, CT 06082.

ADVENTURE. THE KEY IS YOUR COMPUTER

ADVENTURE PACK I

(3 programs)

Jack and the Beanstalk Defeat the Giant in your quest for his Golden Hen.

Computer Adventure Re-live the "excitement" of getting your computer. An adventure with a very different flavor.

Moon Base Alpha You must find a way to destroy the meteor that is racing towards your base, or else all moon colonies will be demolished!

Available for VIC-20 and COMMODORE 64
PLAYED WITH KEYBOARD

\$19.95

ADVENTURE PACK II

(3 programs)

African Escape As the sole survivor of a plane crash, you must find your way out of the dark continent.

Hospital Adventure You are a spy whose mission is to complete the bungled assassination attempt on the evil dictator, who is recuperating in the hospital under heavy guard.

Bomb Threat Get back to town to warn the authorities of the bomb planted by the terrorists who left you prisoner at their hideout.

Available for VIC 20 and COMMODORE 64
PLAYED WITH KEYBOARD

\$19.95



KONGO KONG

Climb ladders, avoid the barrels the crazy ape is rolling at you, and rescue the damsel. Fast machine code action.

Available for VIC-20 and COMMODORE 64
PLAYED WITH JOYSTICK OR KEYBOARD

\$19.95



GRAVE ROBBERS

Introducing the first GRAPHIC ADVENTURE ever available on the VIC-20! With realistic audio-visual effects, you explore an old deserted graveyard and actually see the perils that lie beyond.

Available for VIC-20 and COMMODORE 64
PLAYED WITH KEYBOARD

\$14.95

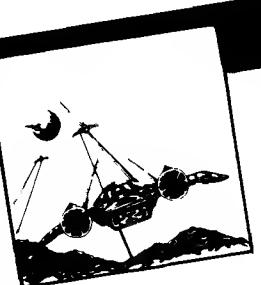


ANNIHILATOR

Defend your planet against the hostile aliens. All machine code makes this "Defender-like" program one of our best arcade games.

Available for VIC-20 and COMMODORE 64
PLAYED WITH JOYSTICK

\$19.95



CHOMPER MAN

High speed machine action. Don't let the bullies catch you in a game packed full of machine code.

Available for COMMODORE 64
PLAYED WITH JOYSTICK OR KEYBOARD

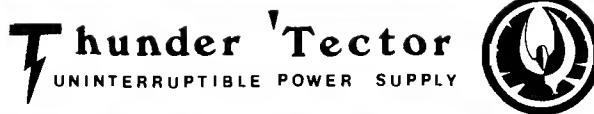
\$19.95

VICTORY
SOFTWARE®

7 Valley Brook Road, Paoli, PA 19301
(215) 296-3787

7 VICTORY SOFTWARE INC.

</



DON'T BE LEFT IN THE DARK!
For \$295, you can protect YOUR
Data, Time and Computer.

Protect your computer operation from loss of data files, lost keyboard input, and questionable integrity of stored information due to power failure. Operation is completely automatic, just attach your own 12V battery, or purchase below.

Available for:

Apple, Radio Shack, IBM, Olivetta, and most other personal and business computers. Specify equipment to be attached when ordering.

If not completely delighted, return in original condition within 30 days for refund. Ten percent restocking fee will be charged. Ninety-day factory warranty.

Gel battery pack available with cables: 1-amp. computers - \$65; 2-amp. computers - \$111.

For fastest delivery, send certified check or money order payable to "Thunderhawk." Send 10% with C.O.D. orders. Sent FOB, Texas. Price subject to change without notice. Texas residents add 5% sales tax. Broad selection of power ranges available for larger computers — call for prices.

DEALER INQUIRIES INVITED — send on letterhead.

Thunderhawk Manufacturing (214) 586-6256
 A Division of Thunderhawk Corporation
 P.O. Box 573
 Jacksonville, TX 75766

© 1983 Thunderhawk Corporation

MICROSPEC

Quit Playing Games . . .

Disk Based Software to Make Your Computer Get Down to Business

Disk Data Manager—Create and manage your own data base. Allows you to create, add, change, delete, search, sort, print, etc. Up to 1200 records on a single disk.

VIC 20 . . . 59.95 CBM 64 . . . 89.95

Payroll System—Full featured, complete payroll system. Even prints checks.

VIC 20 . . . 89.95 CBM 64 . . . 99.95

Mailing List—Up to 1200 records on a single disk. Presorts by Zip Code. Prints on stock up to four labels wide.

VIC 20 . . . 44.95 CBM 64 . . . 54.95

Inventory Package—Maintains quantity on hand, cost, sales price, reorder point, etc. Generates suggested reorder, sales report, and sales analysis.

VIC 20 . . . 89.95 CBM 64 . . . 99.95

General Ledger—Up to 75 accounts! Generates Balance Sheet, Income Statement, Update Report, etc.

VIC 20 . . . 89.95 CBM 64 . . . 99.95

Checkbook Manager—Up to 25 expense categories. Tracks all outstanding checks until they are paid.

VIC 20 . . . 49.95 CBM 64 . . . 69.95

Commodore 64 and VIC 20
are registered trademarks of Commodore

CONTACT YOUR DEALER FOR COMPLETE INFORMATION ON ALL YOUR DISK-BASED SOFTWARE NEEDS

Send Self-Addressed Stamped Envelope for Catalogue of Games and other Applications

DEALER INQUIRIES WELCOME



P.O. Box 863085
 Plano, Texas 75086
 (214) 867-1333



VISA and MASTERCARD Accepted Circle No. 57

SOPHISTICATED TELE-COMMUNICATION IS HERE

THE COMMUNICATOR

for 4.0 Commodore Computers

JIM STRASMA'S REVIEW:

"THE BEST TERMINAL PACKAGE I'VE SEEN YET"

By April 1 (maybe sooner) It Will Be Even Better

SPEEDS UP TO 9600 BAUD

XON — XOFF

TRUE CTRL KEY (we do our own keyboard scan)

THE HARDWARE — A printed circuit board; easily installed in the CBM. It uses no CBM connectors; gives a serial port with true RS232C standard.

THE SOFTWARE —

- Emulates the ADDS Regent 100, ADM 31 and/or the TeleVideo 950.1 Or choose the VT100 model for use with DEC and VAX computers.
- Runs coresident with BASIC programs; lets BASIC programs and program on host computer communicate to develop real-life sophisticated communication and control capabilities.
- The program is on ROM at either address; no disk loading required. Uses only 512 bytes of RAM; will relocate itself around any other machine language program at top of memory.
- Will upload and download and run BASIC programs. With BASIC program will upload and download standard data files. 100 page manual gives program listing for BASIC programs.

Excellent text editor designed to work with THE COMMUNICATOR
THE COMMUNICATOR \$200

Text Editor \$40

1200 baud modems beginning at low, low \$385, and even less when purchased with THE COMMUNICATOR

AMPLIFY, INC.

2325 Macbride, Iowa City, Iowa 52240 319-337-8378

1 trademarks Adds Regent, Inc., Lear Liegler, Inc., Televideo Systems, Inc.

Circle No. 58

THE NEWEST RELEASE FROM ARTISAN SYSTEMS CORP.

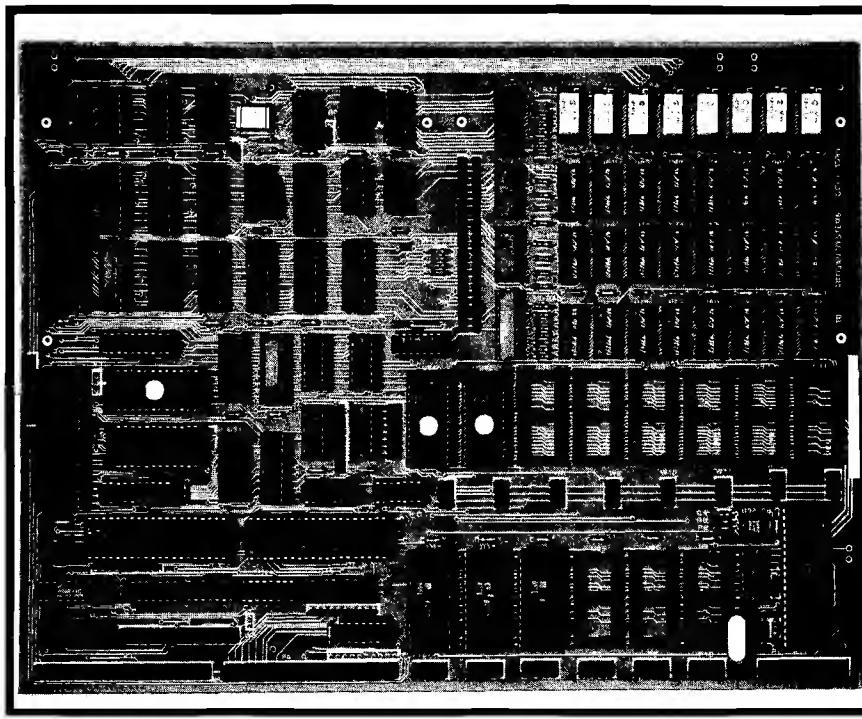
DP-09

2MHZ
OPERATION

256K DRAM

6 RS-232
SERIAL PORTS

8 28-PIN
SOCKETS



DUAL 68B09E
PROCESSORS

FLOPPY
CONTROLLER

WINCHESTER
INTERFACE

4 LAYER
PC BOARD

6809 BASED SINGLE BOARD SYSTEM

12" X 9"

5V, 4A

±12V, 2A

FEATURES:

- ⊕ 68B09E ADVANCED 8/16 BIT SYSTEM PROCESSOR WITH
MEMORY MANAGEMENT HARDWARE ALLOWS FOR
ONE MEGABYTE ADDRESS SPACE
- ⊕ 64K - 256KBYTE DRAM
- ⊕ 8 EACH 28-PIN SOCKETS FOR UP TO 128KBYTE EPROM
EPROMS CAN BE 2732, 2764 OR 27128
IN ADDITION 2KX8 OR 8KX8 STATIC RAMS MAY BE USED
- ⊕ SIX RS-232 SERIAL PORTS WITH FULL MODEM HANDSHAKE
ADVANCED 6551A ACIAS WITH SOFTWARE BAUD RATE
SELECT OF 110 TO 19.2KBAUD
- ⊕ 6522A INTERFACE CHIP PROVIDES TWO 16-BIT TIMERS
PLUS TWO 8-BIT PARALLEL PORTS (UNBUFFERED)
- ⊕ 8 AUTO-VECTORED INTERRUPTS FOR HIGH SPEED I/O HANDLING
- ⊕ 50-PIN EXPANSION SOCKET

- ⊕ INDEPENDENT 68B09E SUBSYSTEM FOR DISK CONTROL
1-4 FLOPPYS 5" OR 8" SS DS SD DD
SASI INTERFACE ALLOWS 5-45MBYTE WINCHESTERS
TO BE CONNECTED USING EXTERNAL CONTROLLER
THE SUBSYSTEM USES A PROPRIETARY DMA TECHNIQUE
FOR HIGH SPEED OPERATION
- ⊕ FLEX OPERATING SYSTEM IS AVAILABLE

PRICES:

DP-09 A&T 64K 4 SERIAL PORTS	\$795(1-9)
FLEX FOR DP-09	\$150
OS-09 LEVEL ONE & TWO	CALL
FORTH	CALL

ARTISAN SYSTEMS CORP.
410 CROSS ST.
WINCHESTER, MA 01890
(617) 721-2109

TERMS:

- ALL ORDERS PREPAID, VISA, OR MASTERCARD
- ALLOW 3 TO 4 WEEKS FOR DELIVERY
- ADD 2 WEEKS FOR PERSONAL CHECKS

Circle No 59

68000 ADDRESSING MODES

by Joe Hootman

Immediate Addressing

Immediate addressing is used to load a constant into a register. As an example, to load the data register D0 with the hexadecimal 55, the instruction that would load D0 immediately with 0055 is given below:

MOVE.W #\$55,D0. The equivalent opword code which is entered into memory is 303C. The # sign indicates immediate addressing, and the \$ indicates a hexadecimal number.

It is worthwhile at this point to examine the format of the MOVE instruction in the previous example as the format is typical of all the 68000 instructions. The mnemonic MOVE expresses the intention, in this example, of moving data into the data register. The W following the MOVE instruction indicates that it is intended that 16 bits of data be moved into D0. In this particular example the high order byte was zero filled. If the letter following the instruction is a B, one byte of data would have been moved into D0. If the letter following the instruction is an L, a long word (32 bits) would be moved into D0. The size field in the opword designates the length of the data. For each of the different lengths of data to be moved there will be a different opword.

The general format of the MOVE instructions is represented in the following format:

Instruction	Word Size	Source,	Destination.
Mnemonic	B,W,L	Defined by the Addressing Mode	Defined by the Addressing Mode.

The MOVE instruction moves data from a designated source, in this case the source being the immediate Hex data 0055. The destination of data in this case would be the data register D0. The bit pattern for the instruction opword is (0011 000 000 111 100).

Note that the destination field as defined by the opword for MOVE does not allow for movement of data into the address register. The movement of data to the address registers is accomplished by using the instruction MOVEA. MOVE and MOVEA are identical except that MOVEA uses a fixed code for the mode of the destination. When loading data into the address register using the MOVEA instruction, the sign bit is extended.

The addressing modes clearly cannot be used to implement instructions that make no sense. For example, MOVE instructions cannot be used with addressing modes that have no way to designate the register or memory to be the destination. These addressing modes would include the PC offset, PC indexed, and immediate addressing modes for the destination effective address.

If only a byte is to be loaded into a register, the MOVEQ instruction should be used. The byte of data is included as a part of the opword; the low order 8 bits (0-7) are the data bits of the word.

To load D0 using the MOVEQ instruction the following opcode and opword would be used:

MOVEQ #\$55,D0 (7055 opword code).

Many cross assemblers automatically use MOVEQ for the instruction to MOVE an immediate byte.

Direct Addressing

Two different direct addressing modes make use of either the address register or a data register. Direct addressing can be used to copy a data register into another data register or an address register. For the MOVE instruction this addressing mode requires that one of the registers be previously loaded with the appropriate data.

For example, if you want to move the contents of A0 to D0, the proper mnemonic is MOVE.L A0,D0. The opword for this instruction is 2008. Note that when dealing with register-to-register transfer of data, byte moves are not allowed. The EXG instruction exchanges the contents of the specified registers.

Implied Addressing

Many instructions do not need to have the addressing modes specified. This type of addressing is called implied addressing. For example, the Branch always (BRA) instruction always uses the PC register and the PC need not be designated each time.

Indirect Addressing

Many variations of the indirect addressing modes are implemented in the 68000:

1. Address register Indirect
2. Address register Indirect with Postincrement
3. Address register Indirect with Predecrement
4. Address register Indirect with Displacement
5. Address register Indirect with Index

When using indirect addressing it is assumed that the address register contains the address where the data is located and/or where the data are to be placed. If you want to load the D0 register with the contents of memory locations \$1500 and \$1501, the assumption is made that A0 is loaded with \$1500. To use address register indirect the following mnemonic is used.

MOVE.W (A0),D0

If the address location \$1500 has stored in it AA, then bits 15-8 of D0 will be loaded with AA. Note that the contents of address \$1501 will be loaded into bits 7-0 of D0.

Address Register Indirect with Postincrement and Predecrement

Many times it is important in a program that an address be either incremented or decremented from a

previously established value. This is particularly true when tables of numbers or other types of tabular data are being searched. In either the post-increment mode or predecrement mode the value of the designated address register is considered to be the base value.

When using the postincrement mode of addressing the base address register is incremented *after* the base address is used. The predecrement mode decrements the base address register and then uses it to point to the desired address. The amount the register is incremented or decremented depends on the size of the operand. Byte increments/decrements by 1, word by 2, and long word by 4. The stack pointer is always incremented/decremented by 2 or 4 to insure that stack pointer stays on a word boundary.

The examples below illustrate the use of the postincrement addressing mode to load data when the size of the word changes from word length data, to byte length data and finally to long word data.

Memory			
A. MOVE.W [A0] +,D0 [3018] Opword		Address	Data
Before execution	After execution	1500	0F
A0 00001500	A0 00001502	1501	01
D0 00000000	D0 00000F01	1502	02
B. MOVE.B [A0] +,D0 [1018] Opword		1503	03
Before execution	After execution	1504	04
A0 00001500	A0 00001501	1505	05
D0 00000000	D0 0000000F	1506	06
C. MOVE.L [A0] +,D0 [2018] Opword		1507	07
Before execution	After execution	1508	08
A0 00001500	A0 00001504	1509	09
D0 00000000	D0 0F010203		

Note from this example that the base register A is incremented once for a byte transfer, twice for a word transfer, and four times for a long word transfer. The base register for the predecrement mode is handled in a manner similar to the postincrement mode in that the base register is decremented once for byte data, twice for word data, and four times for long word data.

To illustrate the nature of the predecrement mode of operation, consider an example similar to the previous one.

Memory			
A. MOVE.W -(A0),D0 [3020] Opword		Address	Data
Before execution	After execution	14F5	F5
A0 00001500	A0 000014FE	14F6	F6
D0 00000000	D0 0000FEFF	14F7	F7
B. MOVE.B -(A0),D0 [1020] Opword		14F8	F8
Before execution	After execution	14F9	F9
A0 00001500	A0 000014FF	14FA	FA
D0 00000000	D0 000000FF	14FB	FB
C. MOVE.L -(A0),D0 [2020] Opword		14FC	FC
Before execution	After execution	14FD	FD
A0 00001500	A0 000014FC	14FE	FE
D0 00000000	D0 FCFDFEFF	14FF	FF
		1500	0F

The automatic incrementing and decrementing features of the 68000 make the movement of data tables in the memory of the 68000 a relatively straightforward problem. For example, if you want to move data from a table, A0 would be set to the low address of the original table and A1 would be set to the low address of the new table, an instruction MOVE.W [A0] +, [A1] + would be executed in a loop until the appropriate number of data words were moved. Note the data of the table can be reordered relatively easily by allowing one of the base address registers to predecrement.

Address Register Indirect with Displacement

Many times it is necessary to retrieve data from a fixed location in a table. The address of beginning or end of the table is loaded into an address register. The fixed displacement, either positive or negative, into the table from the address register is incorporated in the opcode for the address register indirect with displacement.

The displacement is expressed in two's complement form, and thus the effective address can be displaced either up or down from the address established in the base address register. At the end of the execution of this statement the base address register is left unchanged.

The example below illustrates the use of address register indirect with displacement. In this example D0 is to be loaded with data located six locations away from the base address register A0.

Memory			
MOVE.W 6[A0],D0 [3028] Opword		Address	Data
	(0006) Postword	1504	04
		1505	05
Before execution	After execution	1506	06
D0 00000000	D0 00000607	1507	07
A0 00001500	A0 00001500	1508	08

If the data was to be found in a location 6 less than the base register (\$1500), the instruction would have been written with the displacement in two's complement form.

Memory			
MOVE.W -6[A0],D0 [3028] Opword		Address	Data
	(FFFA) Preword	14F7	F7
		14F8	F8
Before execution	After execution	14F9	F9
D0 00000000	D0 0000FAFB	14FA	FA
A0 00001500	A0 00001500	14FB	FB
		14FC	FC
		14FD	FD

The offset cannot place the memory at an odd address. For example, the offset cannot be \$5 in the previous example.

This information was compiled with the assistance of Motorola, Inc.

Addressing Modes will be continued next month.

You may contact Professor Hootman at the University of North Dakota, Dept. of Electrical Engineering, University Station, Grand Forks, ND 58202.

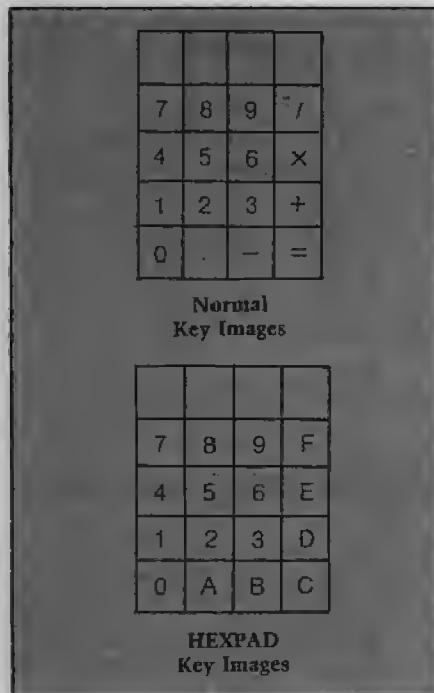
MICRO

HEXPAD: UTILITY FOR MACHINE LANGUAGE KEY-INS

**This utility redesigns
the PET calculator
keypad. Use it when
you need to type in
a published
machine-language
program.**

by Bob Sullivan

HEXPAD is a fifty-six byte tool that converts your PET calculator pad into a hexadecimal key pad:



This utility is designed to be used while entering data *via* the machine-language monitor. It has been used successfully on 4032 and 2001 PETs to type in and save a relocated version of itself. Published machine-language programs such as Micromon, Basic-Aid, or Face can be more conveniently entered with this handy software tool.

HEXPAD is "wedged" into the hardware interrupt routine. It checks to see if the last key entered is a target key or key image to be changed. Whenever a target key is entered, a cursor left and replacement image are immediately printed.

Entering and Running HEXPAD

Use your monitor or assembler to enter the hexadecimal code for HEXPAD or use your assembler. After you have entered the code, SAVE it to tape or disk. Then check the contents of addresses \$90-\$91.

```
.M 0090 0091
.: 0090 55 E4 XX XX XX XX XX XX
■
```

If the first two locations don't contain 55 and E4, take note of them, since you must make changes in the HEXPAD.

(Continued on page 92)

VIC-20 USERS: Get Serious With A PROMQUEEN

- A cartridge development system
- Comprehensive manuals
- Program from Commodore VIC-20 keyboard into built-in 4K ROM emulator
- Jumper to target ROM socket
- Test programs in circuit
- Fits EXPANSION PORT
- Includes Hexkit 1.0, a powerful 100% machine code editor/Debugger utility program that makes coding for 8-bit Micros a snap.
- Built-in EPROM programmer and power supply
- Burns & runs EPROMS for the Commodore VIC-20, too

Programs 2716, 2732, 2732A, 27C16, 27C32, adaptable to 2532 & 2764



PROMQUEEN CARTRIDGE COMPLETE ONLY \$199

	US	Canada
Promqueen 64	\$299.00	\$399.00
8K board with 1 EPROM	\$29.95	\$39.95
16 board with 1 EPROM	\$39.95	\$49.95
8K board with 1 EPROM, C64	\$39.95	\$49.95

Send for Free Brochure

**GLoucester
COMPUTER, INC.**

Circle No. 60

Distributed in U.S. by **Arbutus Total Soft, Inc.**, 4202 Meridian, Suite 214, Bellingham, WA 98226. Phone 800-426-1253, in Washington 206-733-0404

Distributed in Canada by **IBC/Distribution Canada**, 4047 Cambie St., Vancouver, BC V5Z 2x9. Phone 604-879-7812

ROCKWELL Microcomputers from Excerpt, Inc.

• • SPECIALS • •

A65-1 (1K RAM)	\$435
A65-4 (4K RAM)	\$455
A65-4B,4F (4K, BASIC or FORTH*)	\$495
A65-4AB (4K, BASIC & Assembler)	\$525
A65/40-5000 (32K RAM)	\$1250

LANGUAGES for AIM-65® & AIM 65/40

Assembler	\$35
BASIC ROMs	\$65
FORTH* ROMs	\$65

ENCLOSURES & POWER SUPPLIES

A65-006	\$175
ENC4A	\$115
ENC5A	\$130
ENC6A	\$140

RM 65 SERIES
Deduct 5% from list if
ordered with AIM 65® or
AIM 65/40.

REPAIR SERVICE

(out of warranty only)
\$25/hr. plus parts - \$25 min.

SPARE PARTS
are available



CASH DISCOUNT -Deduct 5% for Prepaid Orders
(we pay shipping)

TERMS:

Net 30 from approved Companies & Institutions — otherwise COD.
Shipping will be added to order. Minnesota residents add 6% sales tax.
Prices subject to change without notice.

Authorized Dealers for:

ROCKWELL INTERNATIONAL CORP.,
CUBIT, MTU, FORETHOUGHT PRODUCTS, GORDOS,
SEAWELL, DYNATEM, APPLIED BUSINESS COMPUTER

AIM-65 is a registered trademark of Rockwell International Corp.

*FORTH is a registered trademark of Forth, Inc.

Circle No. 61

Educational Computer Division EXCERPT INCORPORATED

- SALES
- SERVICE
- INSTALLATION
- CONSULTING

P.O. Box 8600
White Bear Lake
Minnesota 55110
(612) 426-4114

Enter 00 and 10 (the starting address of HEXPAD) and press RETURN.

Unless you have a different IRQ address, you are now ready to use HEXPAD. Each time you use the program, you must change the contents of \$90,\$91 to contain the starting address of the HEXPAD routine. Each time you switch back to BASIC you must disable HEXPAD by replacing the IRQ vector. [If you don't, you'll continue to get 'A' when you type a period, etc.]

If the current IRQ address is not \$E455, then line 260 or the object code in line 450 must be changed to aim at the current IRQ address — or else crash:

Line 260 IRQ .DE \$E455 (4032)
(\$E62E-3.0 ROMS)
Line 450 IRQ.JMP JMP IRQ
(4C 55 E4)

Locating HEXPAD

Relocating HEXPAD by changing the object code in lines 470 and 480 relative to the new address:

Line 470 JSR KEYCHK2 (20 1C 10)
Line 480 JMP IRQ.JMP (4C 13 10)

Or change the beginning assembly address in line 210:

Line 210 .BA \$1000

The Program

Conditions

Lines 330 to 470 include three conditions that must be met before a key image is checked. First, the program checks the column variable in zero page address \$C9. If the cursor is not yet in the tenth column then an image change is not needed. Also, this eliminates problems with those periods that the monitor types in column one. Next, if any keys other than 0 to 9 have not been pressed then the program jumps to the KeyCheck subroutine.

KeyCheck

Lines 520 to 580 compare the last key entered [the ASCII code is kept as a

variable in zero page address: \$D9] with the values in 'Table' [lines 740 to 790]. A match causes a branch to the NewKey subroutine.

NewKey

Lines 610 to 670 print a cursor left. Next, the table is set up so that the Y-register increment plus #\$3F gives the ASCII value for the desired replacement image. With this value in the accumulator, a JSR to @WRT (\$FFD2) will print the replacement image. The program concludes each time by jumping to the normal IRQ address.

Special thanks to Brent Anderson for helping me get started with ASSM/TED and MAE, and to Jim Strasma for initiating ATUG, which provides assembly-language examples.

The author may be contacted at P.O. Box 2247, Oak Park, Illinois, 60301.

MICRO

GRANITE COMPUTER SYSTEMS

THE DISASSEMBLER FAMILY

Source listings identical with TSC 6809 EDITOR - User symbol tables - Local and global labels and expressions - Occurrence numbered local labels - Easy identification of Data Areas - FCB - FDB - FCC - Step (optional) disassembly one program or data statement at a time - Source code disc or tape for TSC EDITOR input - Run TSC ASSEMBLER with no or minimal editng Monitor and FLEX references are named - Equate table for all external references - Problem codes flagged (6800 & 6502)

Convenient menu driven options carry out tedious error prone disassembly operations - rapidly and accurately.

6809 to 6809 DISASSEMBLER	\$75.00
6800 to 6809 DISASSEMBLER	\$75.00
6502 to 6809 DISASSEMBLER	\$75.00

TEXTWRITER II - A complete Text Processor to use with the TSC TEXT EDITOR - The two programs run as one - All features you expect in a full text editing and processing system - (For example: Embed print control characters) - Menu driven

Disk only \$75.00

TEXTWRITER I - A basic Text Processor program to use with the TSC TEXT EDITOR - with most of the features of TEXTWRITER II Specifically for tape systems

Cassette only \$50.00

EPROMMER - Use with the SWTPC MP-R Programmer \$40.00

FILEMANAGER - Use with the JPC TC-3 high speed I/O board - comprehensive cassette oriented operating system. \$40.00

All efficient - well documented - and - VERY FRIENDLY Run on any S550 6809 with No or Minimal changes - Provided Object (Binary) programs on 5 & 8 FLEX discs or KC cassette Inquire about Color Computer availability - Non-FLEX

GRANITE COMPUTER SYSTEMS

Route 2 Box 445
Hillsboro, NH 03244
M/C VISA (603)464-3850

Circle No. 62

TAYLORMADE SOFTWARE • TAYLORMADE

Expanded offering of Educational Software for the COMMODORE 64

• **Touch Typing Tutor (TTT64)** diskette \$24.95 cassette \$19.95 Ideal for typing students or computer users. Learn to type with all fingers on your computer's keyboard by following the keyboard and finger placement pictured on your TV screen. 19 lessons fully described in 12-page manual. Select PRACTICE and type computer generated pseudo words for your rate and list of errors. Select TEXT and practice English words for timed test of any duration.

for the VIC-20

• **Touch Typing Tutor 3.0 (TTT5K)** cassette \$19.95 Has same features as TTT64 above. Will run on basic VIC. Four separate programs. Enhanced version now provides practice typing English words. Includes 12-page manual. Selected by Denver Public Schools to train 700 elementary students in keyboard skills.

• **Fun Fractions (FF+8K)** diskette \$24.95 cassette \$19.95

The fun way to learn addition, subtraction, multiplication, and division of fractions for grades 4-9 with sound, color, and graphics. Watch VIC show you all the intermediate steps on the screen blackboard. Then take a turn and see if you can answer before the parachute jumper crashes. Three levels of difficulty. Help is given for incorrect answers; learn your score. Requires 8K (or more) memory expansion. Includes 16-page manual.

Foreign orders payable U.S. dollars plus \$3.00 shipping/handling

TAYLORMADE SOFTWARE

P.O. Box 5574
Lincoln, NE 68505
(402) 464-9051



Circle No. 63

Commodore 64 and VIC-20 are trademarks of Commodore Business Machines Inc

TAYLORMADE SOFTWARE • TAYLORMADE

PUT PRICES IN CHECK

CARTRIDGE RIBBONS FOR

APPLE PRINTERS

NEC 8023A

C. ITOH PROWRITER

\$9.95 EA. \$107.46 DOZ.

CARTRIDGE RIBBONS FOR

EPSON

MX-80 MX-100

\$6.99 EA \$11.95 EA
\$86.29 EA \$129.06 DOZ

MAXELL
DISKETTES

5 1/4" SINGLE SIDE
DUAL DENSITY
MD-1

\$29.90
10 PACK

INNOVATIVE
CONCEPTS
FLIP'N'FILE

DISC STORAGE BOX
HOLDS UP TO 60 DISKETTES
5 1/4" 8"

\$24.95 EA \$29.95 EA

RIBBONS FOR
IDS PRINTERS

	EA	DOZ
440	\$2.77	\$29.92
PAPER TIGER	\$6.95	\$75.06
MICROPRISM	\$7.99	\$86.29
PRISM	10.95	118.25

**DISKETTE
STORAGE
BOXES**

5 1/4" — BLUE OR BEIGE

\$2.49
EA.

DUAL SPOOL RIBBONS FOR
**OKIDATA
PRINTERS**

80, 82, 83	EA	DOZ
92, 93	\$2.77	\$29.92
84	\$5.99	\$64.69

**MEMOREX
DISKETTES**

5 1/4" SINGLE SIDE - DUAL DENSITY

\$24.99
10 PACK

**COLOR-
CODER**
LIBRARY CASE SET
CONTAINS 5 BRIGHT COLORS

5 1/4"	8"
\$19.95	\$23.95
SET OF 5	SET OF 5

**ANTI-STATIC
SPRAY**
FULL QUART SIZE
WITH DISPENSER
\$6.95
QT.
1 GALLON REFILL \$19.95

CARTRIDGE RIBBONS FOR

COMREX

DAISYWRITER 2000

\$2.49 EA	\$26.89 DOZ
-----------	-------------

**LABEL
SPECIAL**

\$2.99
/ K
(5K MIN)

1 ACROSS 3 x 15/16 CONTINUOUS LABELS

MOST RIBBONS AVAILABLE IN COLORS TOO!

CALL OR WRITE FOR OUR SUPPLIES CATALOGUE
ON ORDERS UNDER \$14.00 PLEASE ADD \$3.00 FOR SHIPPING
MINIMUM RIBBON ORDER \$30.00 OR 1 DOZEN



TOLL FREE 800-343-7706

IN MASS 617-963-7694

PHONES OPEN 9AM-7PM EASTERN TIME

No. 61 - June 1983

Check-Mate™

51 DIAUTO DR P O BOX 103
RANDOLPH, MA 02368

MICRO

Circle No. 64

MASS RESIDENTS
ADD 5% SALES TAX

Parameter Passing in Assembly Language

Part 2

by Randall Hyde

Passing Parameters *via* the Return Address

The most convenient way to pass constants to a subroutine is to follow the JSR instruction with the parameters. A prime example is the PRINT subroutine, which prints a string to the output device. On the 6502, PRINT is usually called in the following manner:

```
JSR PRINT
BYT "PRINT THIS STRING",0
```

The PRINT subroutine would send each character that follows the JSR PRINT statement to the console output device. Normally such a construct would not be allowed in assembly language. After all, on return the 6502 microprocessor would attempt to execute the ASCII character "P" as an instruction code. With a certain amount of trickery this problem can be avoided. Consider the following 6502 subroutine:

```
PRINT    STA ASAVE    ;Save Acc value
        STY YSAVE    ;Save Y reg val
        PLA         ;Get LO byte of
        PLA         ;rtn adr
        STA ZPAGE   ;and save in a
        PLA         ;zero-page loc
        PLA         ;Get HI byte of
        PLA         ;rtn adrs
        STA ZPAGE+1 ;and save in a
        PLA         ;zero-page loc
        INC ZPAGE   ;Add one to the
        PLA         ;rtn address
        BNE 1       ;so it points at the
        INC ZPAGE+1 ;true rtn addr
        LDY #0
1      PRTLOOP  LDA (ZPAGE),Y ;Fetch each
                PLA         ;character until
                BEQ ALLDONE ;a zero byte
                PLA         ;is found
                JSR PUTC   ;Print character
                PLA         ;character
                INC ZPAGE   ;Move to the next
                PLA         ;character
                BNE PRTLOOP
                INC ZPAGE+
                JMP PRTLOOP
```

MICRO

```
; Zero byte detected. Use this address as the
; new return address
;
ALLDONE LDA ZPAGE + 1
        PHA
        LDA ZPAGE
        PHA
        LDA ASAVE    ;Restore acc
        LDY YSAVE    ;Restore Y reg
        RTS         ;Return to loc
                ;just past zero
                ;byte
```

Whenever you jump to a 6502 subroutine, the return address left on the stack is the address of the next instruction, *minus one*. By POPping the return address off the stack and adding one to it you have a pointer to the data that follows the JSR statement. In the previous example this pointer was used to fetch the characters one at a time until a zero-terminating byte was encountered. Once the zero byte is encountered the pointer to the zero byte is pushed back onto the 6502 stack to be used as the new return address. Since the 6502 expects the true return address minus one to appear on the stack, upon executing the RTS instruction the 6502 continues processing at the instruction immediately past the zero byte.

The PRINT subroutine uses variable length parameters. In this case the end of the parameter list was specified by a special zero byte. Actually, any value can be used to terminate the parameter list as long as that value doesn't appear in the parameter list. Any time a parameter list contains a variable number of parameters, the subroutine being called must be informed as to how many parameters appear on the list. This can be done in one of several ways: you can use a terminating byte (like the PRINT subroutine does) or you can pass to the subroutine some indication of how many parameters are present on the line.

Sometimes a fixed number of parameters will be passed after a JSR instruction. These types of parameters are handled easily. For example, consider the subroutine used to transfer one zero-page location to another:

```
ZTRANS STA ASAVE
        STY YSAVE
        STX XSAVE
        PLA
        STA ZPAGE
        PLA
        STA ZPAGE + 1
        ;
        ; Get data pointed at by first parameter
        ; and store in second.
```

```

LDY #1
LDA (ZPAGE),Y
TAX
INY
LDA (ZPAGE),Y
TAY
LDA $0,X
STA $0,Y

CLC
LDA ZPAGE
ADC #2
TAY
LDA ZPAGE +1
ADC #0
PHA ;Push HI rtn adrs
TYA
PHA ;Push LO rtn adrs
LDA ASAVER
LDY YSAVER
LDX XSAVER
RTS

```

To use this subroutine simply enter the code:

```

JSR ZTRANS
BYT ZPG1,ZPG2

```

and ZTRANS will copy the zero-page memory location pointed at by ZPG1 into the memory location pointed at by ZPG2. [Note: This particular routine is for educational purposes only. The "LDA ZPG1/STA ZPG2" instruction sequence is both faster and shorter and performs the same function.] While ZTRANS isn't a very useful subroutine, it certainly demonstrates how you would pass a fixed number of parameters after the JSR statement.

The 6809, 68000, and 16032 offer additional addressing modes that make picking up parameters after the JSR extremely easy. PRINT coded in 6809 code would look like this:

```

PRINT PSHS A,X ;Save 6809 regs
PRTLOOP LDA [3,S]
    BEQ ALLDONE ;Done yet?
    JSR PUTC ;If not, output it
    INC 3,S ;Increment to
            ;the next char
    BNE PRTLOOP
    INC 4,S
    BRA PRTLOOP
;
ALLDONE INC 3,S ;Increment to
    BNE RTN ;the true rtn
    INC 4,S ;:adrs
RTN PULS A,X
RTS

```

The PRINT subroutine coded in 68000 code is

```

PRINT MOVEM.L D0/A1, ;Save D0 and
        -(SP) ;A1
MOVE.L 12(SP), ;Get rtn adrs
        A1
PRTLOOP MOVE.B (A1)+, ;Get char to

```

```

        D0 ;print
BEQ ALLDONE
JSR PUTC
BRA PRTLOOP
;
ALLDONE ADDQL #1,A1 ;Fix rtn adrs &
MOVE.L A1,12 ;store back on
        (SP) ;the stack
MOVEM.L (A7)+, ;Restore
        D0/A1 ;registers
RTS

```

The 16032's stack architecture makes performing the PRINT subroutine a relatively simple task. The code for the 16032 PRINT routine is

```

PRINT SAVE [R0] ;Save affected
            ;registers
PRTLOOP MOVEB 0[4(SP)] ;Get byte to
        ,R0 ;print
        CMPQB #0,R0 ;Check for end
            ;of string
        Beq ALLDONE
        JSR PUTC ;Send the char
            ;to the console
ACBD #1,4 ;Increment
        [SP], string
        PRT- pointer
        LOOP ;and repeat
        ;loop
ALLDONE ADDQQ #1,4 ;Fix return
        [SP] ;address
        RESTORE [R0] ;Restore the
            ;affected regs
RTS 0 ;Rtn to caller

```

The MOVB 0[4(SP)],R0 instruction takes the value in the stack pointer and adds four to it. This sum points at the return address for the PRINT subroutine (pushing R0 onto the stack added four bytes to the top of the stack). The data at this address (the PRINT return address) is added to the first value, zero, and the byte at this address is fetched and moved to R0. The ACBD instruction adds one to the return address and then branches to the beginning of the PRTLOOP loop.

Passing parameters of fixed length after the JSR on the 6809, 68000, and 16032 is simple; this exercise will be left to the interested reader.

Different Methods of Passing Data

Once the mechanics of parameter transfer are mastered, learning how to pass different types of parameters becomes important. Most of the examples presented thus far (with the noted exception of passing the address of a parameter block) passed their parameters *by value*; i.e., the actual data to be used was passed to the subroutine. Three other forms of parameter transfer are *pass by value* returned, *pass by reference*, and *pass by name*.

Passing parameters by value is easy, fast, and doesn't affect variables in the calling procedure. Most pass-by-value parameters are stored in a temporary memory location (or some processor register) during execution of the subroutine. After execution of the subroutine the memory location used to store the parameter often is used for some other purpose. The value contained in the parameter after the execution of the subroutine is lost and cannot be passed back to the calling subroutine. When a subroutine needs to return data to the calling procedure within one of the parameter variables passed to it, then pass-by-value parameters are inadequate.

To return data within a parameter variable you must pass the address of the variable to the subroutine instead of the value it contains. In one of the previous examples where the address of a parameter block was passed, we did just that. The address was used as a pointer to access data in the parameter. Some sort of indirect addressing mode was used to read data from the parameter block for usage within the subroutine. By storing data into this parameter block (again using an indirect addressing mode of some type) data can be passed back to the calling procedure.

There is one problem with passing variables by reference. As an example, consider the following Pascal procedure:

```

PROCEDURE MIXEDUP(VAR I,J:INTEGER);
BEGIN
    I := 5;
    J := 6;
    WRITELN('I + J = ',I + J);
END

```

Regardless of the input data, you would expect this routine to print "I + J = 11" out to the console device. Since I and J are passed by reference (because of the VAR reserved word in the parameter list) the variables I and J actually contain addresses, not data. So any time you access I or J within the procedure MIXEDUP you are actually accessing the memory location pointed at by I or J.

Now suppose you invoke the procedure MIXEDUP with the call "MIXEDUP(L,L)". The parameter I would contain the address of L in the calling procedure as would the parameter J. Upon executing the statement "I = 5," the procedure MIXEDUP would store the value five in the memory location pointed at by I, which

VIDEO TERMINAL BOARD 82-018

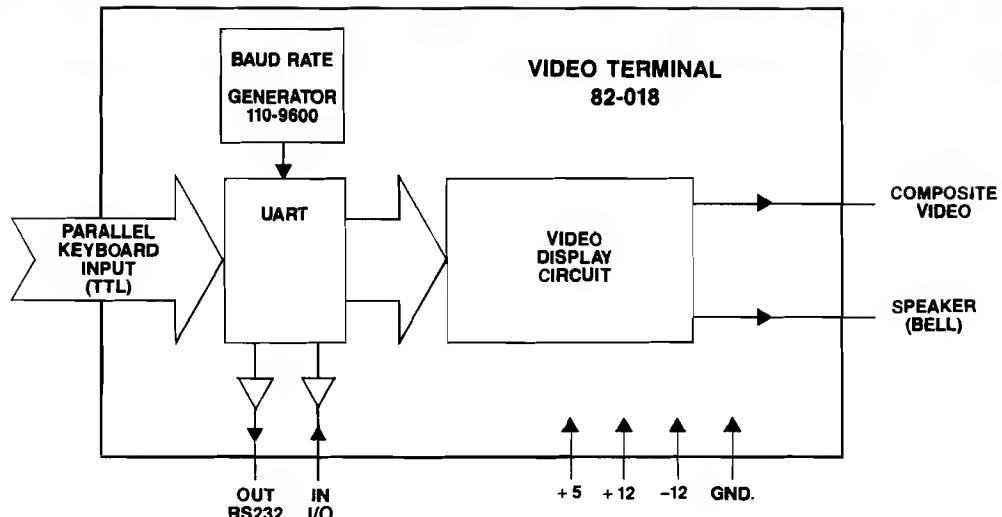
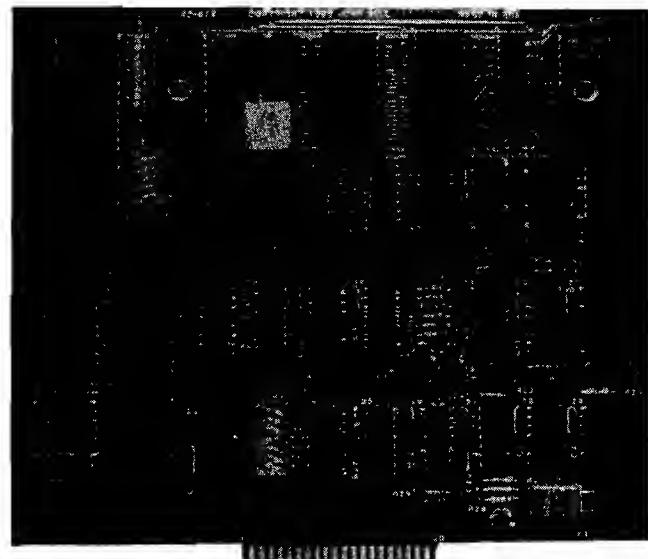
This is a complete stand alone Video Terminal board. All that is needed besides this board is a parallel ASCII keyboard, standard NTSC monitor, and a power supply. It displays 80 columns by 25 lines of UPPER and lower case characters. Data is transferred by RS232 at rates of 110 baud to 9600 baud — switch selectable. The UART is controlled (parity etc.) by a 5 pos. dip switch.

Complete source listing is included in the documentation. Both the character generator and the CRT program are in 2716 EPROMS to allow easy modification to your needs.

This board uses a 6502 Microprocessor and a 6545-1 CRT controller. The 6502 runs during the horz. and vert. blanking (45% of the time). The serial input port is interrupt driven. A 1500 character silo is used to store data until the 6502 can display it.

Features

- 6502 Microprocessor
- 6545-1 CRT controller
- 2716 EPROM char. gen.
- 2716 EPROM program
- 4K RAM (6116)
- 2K EPROM 2716
- RS232 I/O for direct connection to computer or modem.
- 80 columns x 25 line display
- Size 6.2" x 7.2"
- Output for speaker (bell)
- Power +5 700Ma.
- +12 50Ma.
- 12 50Ma.



This board is available assembled and tested, or bare board with the two EPROMS and crystal.

Assembled and tested

#82-018A \$199.95

Bare board with EPROMS and crystal

#82-018B \$ 89.95

Both versions come with complete documentation.



JOHN BELL ENGINEERING, INC.

ALL PRODUCTS ARE AVAILABLE FROM JOHN BELL ENGINEERING, INC. • 1014 CENTER ST., SAN CARLOS, CA 94070
ADD SALES TAX IN CALIFORNIA • ADD 5% SHIPPING & HANDLING 3% FOR ORDERS OVER \$100



SEND \$1.00 FOR CATALOG

(415) 592-8411
WILL CALL HOURS: 9am - 4pm

10% OUTSIDE U.S.A.
ADD \$1.50 FOR C.O.D.



Interface Clinic

by Ralph Tenny

An interface component that was mentioned only briefly in an earlier column is the *latch*. A latch was shown in a circuit designed to capture microprocessor bus data "on the fly" — directly from the bus. Latches have certain special features you need to know. First, there are two kinds of latches: *edge-triggered* and *transparent* latches. An edge-triggered latch will capture data only when a positive-going clock signal is applied to the part; transparent latches have a data input and an enable line. When the enable line is active, the latch output copies the logic state on the data line. When the enable line goes inactive, the latch locks up or captures the data present on the data line. The read/write memory in your computer works the same way; when the R/W* line is low, data from the bus is gated through to the memory cells and the data is captured when R/W* goes high.

All latches have certain critical timing parameters in common: *setup time*, *hold time*, and width of *clock pulse* or *enable strobe*. Setup time specifies how long the data must be present before the clock or enable strobe changes state and ranges from .2 microseconds for CMOS latches to .02 microseconds for TTL latches. Hold time specifies how long the data must remain valid *after* the strobe changes state. CMOS hold times are about .12 microseconds and TTL times are about .005 microseconds. Clock or enable pulse widths range from .2 microseconds for CMOS to .04 microseconds for TTL. Generally, setup and hold times must be taken into account only when parts are driven directly by the microprocessor bus; if the parts are driven by a PIA, timing limits are met easily since the PIA cannot be programmed to change quickly enough to cause timing problems. Figure 1 shows the typical timing waveforms for edge-triggered and transparent latches with the critical timing parameters identified.

Another interface component I have ignored so far is the *shift register*. Figure 2 shows the simplest form of shift register; it is a collection of latches connected in series so that the data output of the first stage drives the

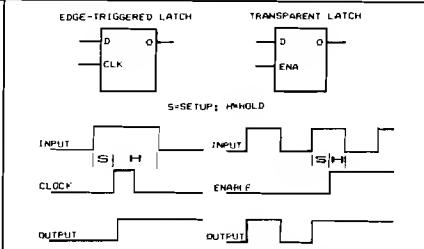


Figure 1: A comparison of edge-triggered and transparent latches showing waveforms and critical timing parameters.

data input of the second stage and so on to the end of the chain. All stages are clocked at the same time, so a logic one clocked into the first stage comes true in the second stage after the second clock pulse. With this kind of logic block it is possible to convert a serial data stream into a collection of parallel bits or data word.

The serial [printer] port on most computers works with a communications protocol known as asynchronous ASCII, which means that the individual groups of bits known as words can be sent and received on an irregular schedule. This is accomplished by the scheme illustrated in figure 3, which defines a single serial word as it might be sent to a printer. In the illustration, a data word has been divided into eleven segments or bits. All words start with the RS-232 Out line low (RS-232 logic one). The first bit is *always* logic zero, and is called the *start* bit. The start bit serves as a timing mark for the receiving circuit so it can know when the data word is coming. The receiving circuit begins counting time and tests

the input line 1½ bit times later, recording whether this bit is logic one or zero. Seven more tests or samples are made at one bit-time intervals, with the logic value of each being recorded. Bits 10 and 11 are called *stop* bits and are always logic ones. In continuous transmission, the last stop bit will be followed immediately by a start bit for the next word; during asynchronous transmission, the next word can be sent anytime.

What I have discussed is one common version of an asynchronous ASCII word; some versions will have only one stop bit, usually at the higher transmission rates. In order for an asynchronous scheme to work properly, both the sending and receiving circuits must be set for the same transmission rate, which normally is expressed as a *baud* rate. The definition of baud rate is that one baud is equal to one bit per second. Typical transmission rates are 300 baud, 600 baud, and 1200 baud; the Radio Shack standard is 600 baud to match Radio Shack printers.

In contrast to asynchronous transmission, some computer communication uses synchronous transmission, where special data-bit patterns signal start of data, end of data, etc. Inherent in synchronous transmission is a clock signal that signals the receiving circuit when to sample to read a bit's logic value.

Last month I used the printer port to send and receive single-bit information. The output level was held steady

Figure 2: A simple shift register can be constructed by connecting a series of edge-triggered latches and using a common clock input.

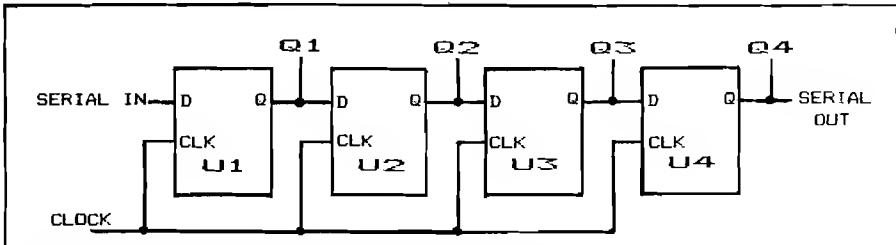
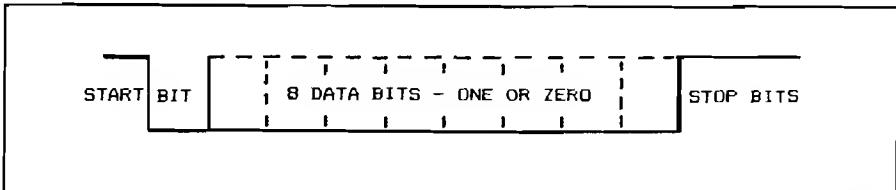


Figure 3: Asynchronous serial transmission must use start and stop bits to allow the receiver to tell when each word starts and stops.



to indicate a logic one or zero, and the computer sampled the input line to determine if an external switch was open or closed. Since not much can be accomplished with single input and output bits, I have designed a scheme to handle more bits.

For this month's experiment I developed a scheme to output multiples of four bits, depending on how many sections I want to hook up. The first hurdle to face on the Color Computer is that there is only one output line; this limitation will probably apply on any computer that uses software to generate a serial data stream. Although it is possible to generate "home brew" circuitry that will receive standard asynchronous signals, I use somewhat simpler circuitry to implement a self-clocking scheme working in four-bit data blocks.

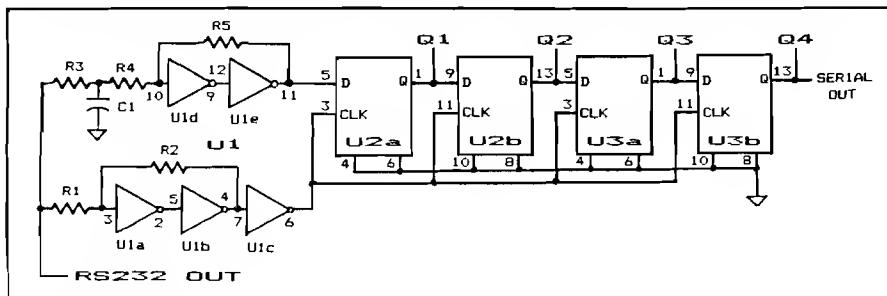
The circuit in figure 4 uses a delay scheme to encode both data and clock on the RS-232 Out signal, and a four-stage shift register captures the data. The circuit shows how to make a shift register from the CD4042 4-bit latch.

U1a and U1b work together to produce very fast signal transitions from the somewhat slower RS-232 Out signal as shown in figure 5. With the input low, U1a's output is high and U1b's output is low. As the input signal rises, R1 and R2 reduce the signal change at the input of U1a, but eventually U1a's input will reach the IC's signal threshold and U1a's output will begin to change, forcing U1b to change also. As the input continues to rise, U1b's output will go high until U2 is helping pull up on U1a's input rather than slowing the input rise. The graph in figure 5 shows the result — a slow level change at the input gives a fast change at the output. This type of cir-

cuit is called a Schmitt Trigger and is useful for interfacing slow signals to computers. U1c inverts the clock signal to provide the proper clock timing.

The network consisting of R3 and C1 acts to delay signal transitions reaching U1d and U1e, which are also connected as a Schmitt Trigger. If the RS-232 line goes high for only a short time, the RS/C1 delay into U1d and U1e prevents the data line from changing, but when the signal stays high long enough, the data line goes high. In either case, when the RS-232 line goes low again, C1 is discharged by R3 and a new cycle can begin. If a latch is connected to both the data and clock lines as shown in figure 4, it will capture either a logic one or a logic zero, depending on whether the RS-232 line stays high a long or short time. This is shown in figure 6, which shows the response of the circuitry in figure 4. The top line is an input from the RS-232 port, and the responses of the data and clock circuits are shown in the next two lines. Only the second input pulse is wide enough for U1d/U1e to change state, and this is reflected by the short period of logic one in the data signal. Meanwhile, the transitions of the clock signal marked with an arrow show when U2 will sample the data line. Assuming that Q1 of the shift register was high at the start, the logic zero of the input signal causes a transition to zero on the first clock pulse. The next data bit sent was a one (long positive pulse), and the second clock pulse captures a one. The third bit sent was a zero, which is captured by the third clock pulse. In order for this circuit to be useful, the RS-232 line must send four bits and stop until the next time data has to be sent. Also, you may

Figure 4: This circuit can be driven by a computer's printer port and will capture four bits of output data. Additional shift register sections can be added to handle more bits.



need driver circuitry such as the LED driver used last month, one driver for each bit stored in the shift register.

Parts List for Experiment #2

U1 — CD4049 (Radio Shack #276-2449)

U2, U3 — CD4013 (Radio Shack #276-2442)

R1, R4 — 82K ohm, 1/4-watt resistor

R2, R4 — 330K ohm, 1/4-watt resistor

R3 — 22K ohm, 1/4-watt resistor

C1 — 1 μ F, 16-volt capacitor (Radio Shack #272-1419)

Power Supply — +5 volts to +10 volts (battery-suitable)

The circuitry in figure 4 can be exercised with the short subroutines shown below. These routines should be called by a program that breaks an output pattern into individual bits, counts the bits as they are output, and then stops transmission.

After a bit of reflection, I renege on one comment I made last month: I said that I would specify parts and materials to be used in projects only as the need arose. I now believe our purposes can be better served by listing materials that you can watch for, possibly saving money by finding items on sale. In particular, Radio Shack often has sales that allow good savings if you can anticipate future needs. When I choose parts for an experiment, you might already have the needed parts and can proceed immediately. The following listed items will be useful for various hardware experiments. You can collect these items gradually or get them as needed (Radio Shack part numbers shown).

Discrete Components

Aluminum Electrolytic assortment: 272-604 or 272-605

1/4-watt resistor assortment: 271-602

Prototyping boards: 276-170, 276-158, 276-153

Transistor assortments: 276-1603, 276-1604

LED assortment: 276-1622

Silicon signal diodes: 276-1620 or 276-1122

Silicon rectifiers: 276-1101

(continued)

CSE means OSI

Software and Hardware
Introducing 5 new disk programs

From DMP Systems:

Superdefender	\$14.95
Universe	\$14.95
Edit-all	\$19.95
De-bug	\$12.95

From Dwo Quong Fok Lok Sow:

WP-6502 Word processor. Available in three versions.

5" disk	\$200.00
8" disk	\$234.95
Cassette	\$39.95

Training Manual

CSE's Rom Source Code Listing 100 Pages! ..\$15.95

NEW! NEW! NEW!

ANCHOR SIGNALMAN MODEMS

Please write for more info on new disk programs or send \$2.00 for catalog. Please include \$2.00 shipping (\$3.00 for modems).

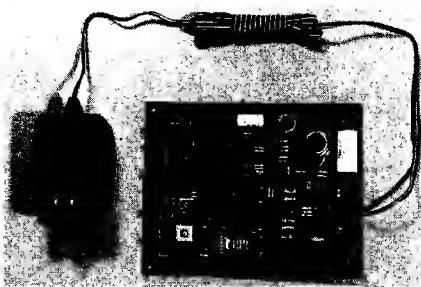


COMPUTER SCIENCE ENGINEERING

Box 50 • 291 Huntington Ave. Boston 02115
617-423-9501

Circle No. 67

Boulder Logical Testing, Inc.
is now offering a new EPROM Programmer
FOR \$195.00



- Microprocessor based
- Programs 2716, 2732, 2732A and 2532 EPROMS
- Zero Insertion Force (ZIF) sockets are standard
- 25 or 22 volt programming voltage option
- Copy from EPROM to EPROM automatically
- RS 232 interface with selectable baud rates
- Thorough user documentation includes example software drivers for popular computer systems, including Apple*, IBM PC*, and CP/M*
- Command set can be used from host computer or terminal
- Comes complete with power supply

To order, or for more information write:

Boulder Logical Testing, Inc.
PO Box 902
Boulder, CO 80306

Ordering information: send money order or check only, no CODs. Price includes shipping costs and documentation. Colorado residents include 3% sales tax.

*Apple is trademark of Apple, Inc. IBM PC is trademark of IBM. CP/M is trademark of Digital Research.

Circle No. 68

Interface Clinic (continued)

Measurement Instruments (Optional, but useful)

Volt-ohmmeter: 22-204, or Digital

VOM: 22-197

Logic probe: 22-301

Figure 5: Two resistors and two CMOS inverters make a circuit that generates fast logic transitions from a slow input signal.

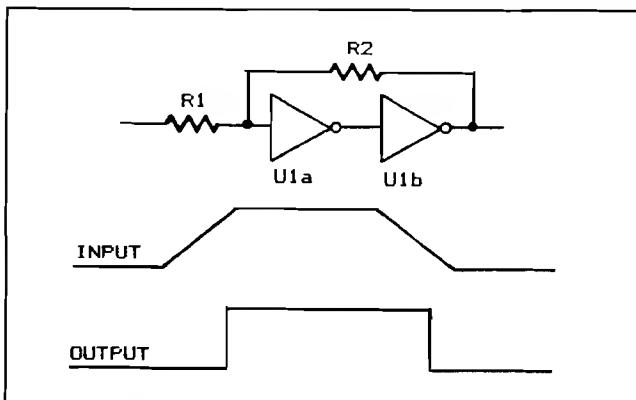
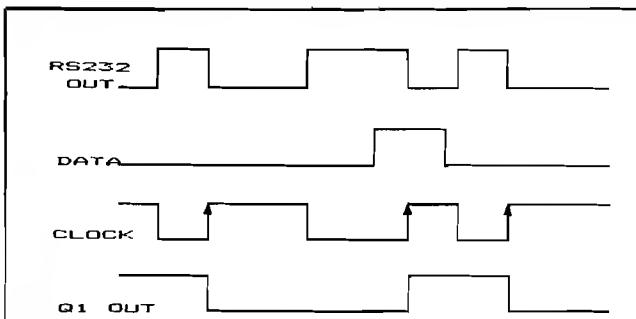


Figure 6: Timing diagram for circuit in figure 4. The input signal encodes both data and clock by varying width of output pulses.



Interface Clinic Listing

```

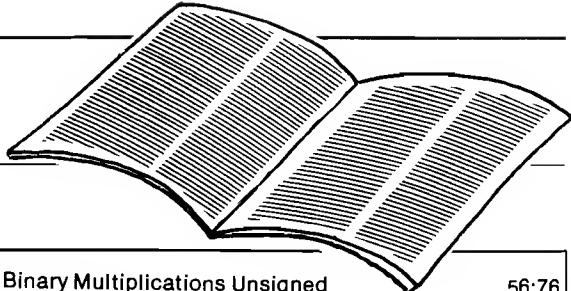
* THIS PROGRAM WILL DRIVE A SERIAL PORT ADAPTER.
* CALL THAT SUBROUTINE WHICH OUTPUTS EITHER A ONE
* OR ZERO AS NEEDED. THE CALLING ROUTINE MUST COUNT
* OUTPUT BITS AND HANDLE THE OPERATOR INTERFACE.
* THE USER MUST DEFINE THE ORIGIN; $2800 USED AS
* AN EXAMPLE.
* EQUATES
    FF20    EQU    $FF20      RS-232 OUTPUT BIT = BIT 1
    0002    EQU    $02        SET BIT 1 HIGH
    000D    EQU    $FD        SET BIT 1 LOW
    0500    LONG   $0500      TIME CONSTANT FOR LOGIC ON OUTPUT
    0280    SHORT  $280      TIME CONSTANT FOR LOGIC ZERO
* SUBROUTINES
2800    ORG    $2800
2800    B6    FF20    ONE    LDA    RS2320  READ PORT BIT PATTERN
2803    B6    02     ORA    #BITHI  SET RS232 BIT HIGH
2805    B7    FF20    STA    RS2320
2808    B6    0500    LDX    #LONG  TIME DELAY FOR LOGIC ONE
2808    30    1F     COUNT1  LEAX   -1,X  COUNT DOWN
2809    26    FC     COUNT1  BNE    COUNT1
280F    B6    FF20    LDA    RS2320  READ BIT PATTERN AGAIN
2812    B6    FD     ANDA   #BITLO  SET RS232 BIT LOW
2814    B7    FF20    STA    RS2320
2817    B6    0280    LDX    #SHORT  REMAINING BIT CELL TIME
281A    30    1F     CNTDN1 LEAX   -1,X  COUNT DOWN
281C    26    FC     CNTDN1 BNE    CNTDN1
281E    39    FF     RTS
281F    B4    FF20    ZERO   LDA    RS2320  READ PORT BIT PATTERN
2822    B4    02     DRA    #BITHI  SET RS232 BIT HIGH
2824    B7    FF20    STA    RS2320
2827    B6    0280    LDX    #SHORT  TIME CONSTANT FOR LOGIC ZERO
282A    30    1F     COUNT2  LEAX   -1,X  COUNT DOWN
282C    26    FC     COUNT2  BNE    COUNT2
282E    B6    FF20    LDA    RS2320  SET RS232 BIT LOW
2831    B4    FD     ANDA   #BITLO
2833    B7    FF20    STA    RS2320
2836    B6    0500    LDX    #LONG  FINISH BIT CELL TIME
2839    30    1F     CNTDN2 LEAX   -1,X  COUNT DOWN
283B    26    FC     CNTDN2 BNE    CNTDN2
283D    39    FF     RTS
END

```

Please forward questions and suggestions for discussion topics to Mr. Tenny at P.O. Box 545, Richardson, TX 75080.

ACRO™

Annual Index



The following two pages are a continuation of MICRO's Annual Index [see MICRO 60:105 for the first installment]. The list is comprised of articles that have appeared in MICRO over the past year and are placed under specific headings for easy reference. The first number indicates the issue and the second number the page of that issue.

LANGUAGES

FORTH

BASIC, FORTH, and RPL	49:63
<i>Timothy Stryker</i>	
Microcomputer Interfacing: FORTH vs. BASIC	49:77
<i>Mark Bernstein</i>	
EDIT: An Atari FORTH Screen-Oriented Editor	57:47
<i>Mike Dougherty</i>	
FORTH for the 6809	57:62
<i>Ronald W. Anderson</i>	
An Introduction to FORTH	57:58
<i>Ronald W. Anderson</i>	

LISP

The World According to LISP	57:65
<i>Steven Cherry</i>	

LOGO

Three Faces of Apple LOGO	53:41
<i>Edward H. Carlson (also see Education)</i>	

PASCAL

Low-Resolution Graphics for Apple Pascal	50:63
<i>Richard C. Vile Jr.</i>	
Introduction to Turtle Graphics in Apple Pascal	53:37
<i>John R. Raines</i>	
Discrete Event Simulation in Pascal	56:21
<i>Anita and Bill Walker</i>	
Apple Math Editor	56:78
<i>Robert D. Walker</i>	
Using Long Integers for BCD Numbers in Pascal	56:86
<i>David C. Oshel</i>	
Apple Pascal Hi-Res Screen Dump	57:54
<i>Robert D. Walker</i>	
Raising Numbers to a Power with Pascal	58:12
<i>Robert D. Walker</i>	

PILOT

Tiny PILOT for the PET	49:73
<i>Jim Strasma and John O'Hare</i>	
More on Tiny PILOT for the PET	57:78
<i>Arthur Hunkins</i>	

RPL

BASIC, FORTH, and RPL	49:63
<i>Timothy Stryker</i>	

APL

SuperPET APL	57:43
<i>Terry Peterson</i>	

MATH

Extending Newton-Raphson's Method to Evaluate Complex Roots	56:71
<i>P.P. Ong</i>	

Signed Binary Multiplications Unsigned

56:76

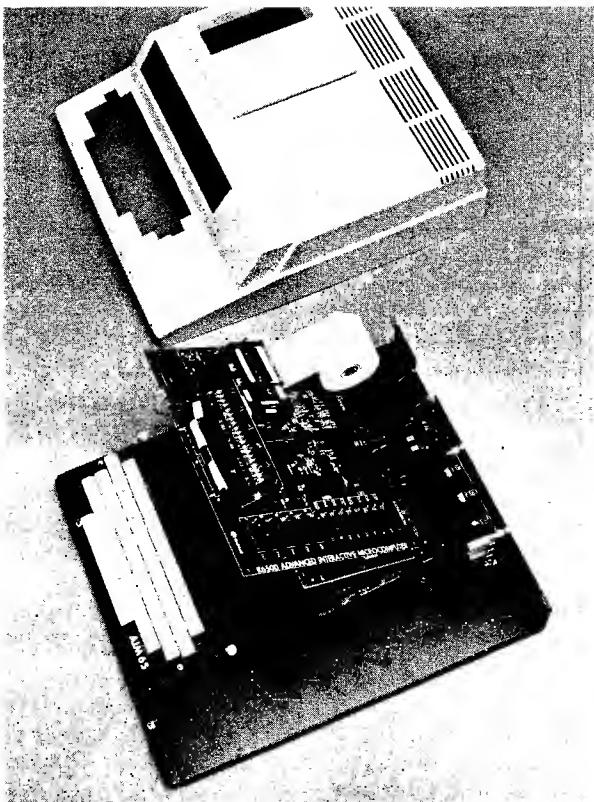
PRINTERS

A Versatile Disc Label Printer	49:50
<i>David Allen</i>	
Building a Parallel Printer Interface	53:23
<i>Rolf B. Johannessen</i>	
The IBM Selectric an an OSI System Printer	53:27
<i>Paul Krieger</i>	
Hi-Res Plotting with the VIC	58:19
<i>Fred Wallace</i>	
Print Control for Apple Printers	58:24
<i>John R. Vokey and H. Cem Kaner</i>	
A Full Byte for Your Apple Printer	58:42
<i>Mark J. Boyd</i>	

TECHNIQUES

Disk to Tape Backup Utility	49:9
<i>Richard Merten</i>	
BASIC, FORTH, and RPL	49:63
<i>Timothy Stryker</i>	
PRINT AT for OSI Systems	49:87
<i>Matt Asay</i>	
Interactive Random Generator	50:105
<i>Harry White</i>	
Left of Equal Sign MID& in Applesoft	50:105
<i>Gustavo Criscuolo</i>	
Structured Programming in 6502 Assembly Language	51:43
<i>Kim G. Woodward</i>	
Pattern-Matching with the 6502 on the Apple	51:49
<i>Charles F. Taylor</i>	
Random Number Generator in Machine Language for the Apple	51:57
<i>Arthur Matheny</i>	
A New Character Set for the VIC-20	51:63
<i>Mike Bassman</i>	
On ERROR GOTO for OSI ROM BASIC	51:85
<i>Earl Morris and Kerry Lourash</i>	
Straightforward Garbage Collection for the Apple	51:90
<i>Cornelis Bongers</i>	
AMPER-POS for the Apple	52:51
<i>Philippe Francois</i>	
6809 Macros for Structured Programming	52:57
<i>Hal Clark</i>	
Atari Character Graphics from BASIC, Part 1	53:87
<i>Paul S. Swanson</i>	
Formatted Output with Atari BASIC	53:75
<i>Frank Roberts</i>	
Sensible Use of Apple Game Paddles	54:66
<i>Harry L. Pruetz</i>	
Apple Hi-Res Graphics and Memory Use	54:79
<i>Dan Weston</i>	
Atari Character Graphics from BASIC, Part 2	54:82
<i>Paul S. Swanson</i>	
Getting Around the Apple Hi-Res Graphics Page	54:93
<i>Eagle I. Berns</i>	
Extra Colors for the Atari	54:96
<i>Richard I. and Donna M. Marmon</i>	
Atari Character Graphics from BASIC, Part 3	55:22
<i>Paul S. Swanson</i>	
Applesoft GOTO/GOSUB Checking Routine	55:26
<i>Peter J.G. Meyer</i>	

(continued)



AIM HIGH

Let Unique Data Systems help you raise your sights on AIM 65 applications with our versatile family of AIM support products.

- Go for high quality with our ACE-100 Enclosure. It accommodates the AIM 65 perfectly, without modification, and features easy access two board add-on space, plus a 3" x 5" x 17" and a 4" x 5" x 15.5" area for power supplies and other components. \$186.00.
- Get high capability with Unique Data System's add-on boards. The UDS-100 Series Memory-I/O boards add up to 16K bytes of RAM memory or up to 48K bytes ROM/PROM/EPROM to your Rockwell AIM 65. You also get 20 independently programmable parallel I/O lines with an additional user-dedicated 6522 VIA, two independent RS-232 channels with 16 switch-selectable baud rates (50 to 19.2K baud), and a large on-board prototyping area. Prices start at \$259.00.
- If you need to protect against RAM data loss, the UDS-100B offers an on-board battery and charger/switchover circuit. \$296.00.
- Heighten your AIM 65's communications range by adding the UDS-200 Modem board. It features full compatibility with Bell System 103 type modems and can be plugged directly into a home telephone jack via a permissive mode DAA. No need for a data jack or acoustic coupler. The UDS-200 also has software-selectable Autoanswer and Autodial capability with dial tone detector. The modem interfaces via the AIM 65 expansion bus, with the on-board UART and baud rate generator eliminating the need for an RS-232 channel. \$278.00.
- The UDS-300 Wire Wrap board accepts all .300/.600/.900 IC sockets from 8 to 64 pins. Its features include an intermeshed power distribution system and dual 44-pin card edge connectors for bus and I/O signal connections. \$45.00.
- Get high performance with the ACE-100-07 compact 4" x 5" x 1.7" switching power supply, delivering +5V @ 6A, +12V @ 1A, and +24V for the AIM printer. \$118.00.

Installation kits and other related accessories are also available to implement your AIM expansion plans. Custom hardware design, programming, and assembled systems are also available. High quality, high capability, high performance, with high reliability... all from Unique Data Systems. Call or write for additional information.

Unique Data Systems Inc.
1600 Miraloma Avenue, Placentia, CA 92670
(714) 630-1430

Circle No. 69

Annual Index (continued)

It's All Relative-CBM Disk Techniques, Part 1	55:37
<i>Jim Strasma</i>	
Utilizing the 6502 Undefined Operation Code	55:93
<i>Curt Nelson, Richard Villarreal and Rod Neisler</i>	
VIC Hi-Res Graphics Explained	56:11
<i>Nicholas J. Vrtis</i>	
It's All Relative-Using CBM Disk Techniques, Part 2	56:52
<i>Jim Strasma</i>	
Extending Newton-Raphson's Method to Evaluate Complex Roots	56:71
<i>P.P.Ong</i>	
It's All Relative-Using CBM Relative Records, Part 3	57:33
<i>Jim Strasma</i>	
SuperPET APL	57:43
<i>Terry Peterson</i>	
Hi-Res Plotting with the VIC	58:19
<i>Fred Wallace</i>	
It's All Relative-Using Commodore's Relative Records, Part 4	58:85
<i>Jim Strasma</i>	
Using Long Integers for BCD Numbers in Pascal	58:12
<i>David C. Oshel</i>	
Raising Numbers to a Power with Pascal	58:12
<i>Robert D. Walker</i>	
Disk ID for Printed OSI Directories	58:36
<i>Robert A. Paul</i>	
Apple Print-Using Routine	58:39
<i>Celestino R. Monclova</i>	
A Full Byte for Your Apple Printer	58:42
<i>Mark J. Boyd</i>	
Apple Disk Track Copy for Non-Matching Volume Numbers	58:82
<i>Roland E. Guilbault</i>	
Unleash the AIM A Block	59:61
<i>Tom Lillevig</i>	
UTILITIES	
Breakpoint Utility for OSI C1P	49:84
<i>John S. Seybold</i>	
Symbol Table Lister for the OSI	49:93
<i>Rolf Johannsen</i>	
Auto Entry for the C1P	50:93
<i>Allen J. Zadraka</i>	
SURCHANGE for the OSI	51:76
<i>Kerry Lourash</i>	
POWER-Aid for the PET	51:71
<i>F. Arthur Cochrane</i>	
OSI Extended I/O Processor	51:99
<i>Michael J. Keryan</i>	
Delete on the OSI	51:106
<i>Earl Morris and Yasuo Morishita</i>	
COMPRESS-An Applesoft Optimizer	52:89
<i>Barton M. Bauers</i>	
Screen Editor for the OSI 65D Assembler	53:19
<i>Les Cain</i>	
Apple ILISZI for Integer BASIC Programs	55:13
<i>Leonard Anderson</i>	
BASIC Macro Function for Cursor Control	55:19
<i>Kerry Lourash</i>	
Programmable Character Generator for OSI	55:88
<i>Colin Macauley</i>	
PROM BASIC for the C1P	57:22
<i>David A. Jones</i>	
Indirect Files Under OS-65D	57:28
<i>Richard L. Trettheway</i>	
BASIC Renumber for OSI	57:40
<i>Paul Krieger</i>	
Improved IEEE-488 Control for PET/CBM	57:77
<i>David W. Priddle</i>	

MICRO

COMMANDER

THE MONTHLY JOURNAL FOR
COMMODORE COMPUTER USERS

SUPER PET



PET/CBM



VIC-20

GET YOUR MONEY'S WORTH

You've probably made a sizeable investment in your computer equipment. **COMMANDER** can help you make the most of it.

Each issue brings you the no-nonsense advice you need to stay on the leading edge of this constantly changing field. **COMMANDER** will be your reference to the world of computers... with the best, most comprehensive coverage you can get!!

Subscribe now and take advantage of our limited offer of \$4 off the one year subscription.

1 YR. U.S. \$22 2 YR. U.S. \$40 3 YR. U.S. \$58
(Prices do not include \$4 Discount) Prices in U.S. Funds Washington residents please add 7.8% sales tax

—Subscription Orders Only—
Toll Free Number: 1-800-426-1830
(except WA, HI, AK)

COMMANDER

P.O. BOX 98827

TACOMA, WASHINGTON 98498
(206) 565-6816

Circle No. 70



32K CMOS STATIC RAM BOARD for SYM/AIM

Models MB-132/32K, \$299
/16K \$241, /8K \$197

Features:

- 200ns Low Power CMOS, STATIC RAM
- Extends your expansion connector
- Plug compatible with 2716 EPROMS
- First 8K are jumper selectable
- Entire board may be bank-switched
- G-10 Glass epoxy, Full solder mask, Gold fingers
- Full 1-year limited warranty



I/O EXPANSION BOARD for the SYM/AIM

and other microcomputers that use 6522 VIAs for I/O and do not provide full address decoding on board. This board has physical space for four additional 6522 VIAs, and provides additional decoding for a total of 16 devices. Connectors for all I/O lines, and further expansion are included. All 6522 functions are available, with no interference with previous functions of the original VIA. Two versions of this board are available. The I/OX-122 mounts above, and directly plugs into an on-board 6522 socket, and relocates the original VIA to the expansion board. Where there are space limitations, the I/OX-222 uses a dip header and an 8" cable for remote installation.

I/OX-122 \$60
I/OX-222 \$72



REAL-TIME CLOCK/CALENDAR \$60 Write for Info.
P.O. Box 1019 • Whittier, CA 90609 • (213) 941-1383

ALTERNATIVE
ENERGY
PRODUCTS

Circle No. 71

MICRO

Speed,

Speed with the **PASCAL SPEEDUP SYSTEM**, our best seller. Features complete ease of use with all APPLE PASCAL; UCSD PASCAL 1.1; APPLE RUNTIME ENVIRONMENT; & FORTRAN applications. From 40 to 150% speed boost on most programs (some even faster). All with no programming and with only one extra watt of power from your power supply.

Power,

Power with the cost efficient 6809 coprocessor, the 8 bit chip with a 16 bit "personality". Enough power to drive multi-tasking OS-9 / BASIC 09, the "Unix-like" operating system with a Pascal-like BASIC for the Apple. It's all in a day's work for **THE MILL**.

Efficiency.

Efficiency with the **ASSEMBLER DEVELOPMENT SYSTEM**; Heavyweights write state of the art programs on the 6809 for DOS 3.3 or even stand alone. Utilities include M.A.P. (McMill Adaptor for Pascal).

"The Stellation Two people have earned my highest respect for assembling an impressive collection of software for their board."

*- Michael Coffey/
Creative Computing Magazine*

"I feel my software output has been greater in the six months I have used OS-9 than it was in the 3½ years previous combined. It has a rakish logical simplicity that nearly defies description... I bill OS-9 as a programmers dream operating system."

*- Brian Capouch/
MICRO Magazine*

Call today or write for more information on this inexpensive Apple II, IIe enhancement.



The Lobero Building P.O. Box 2342
Santa Barbara, Ca. 93120
(805) 966-1140 Telex 658439

Circle No. 72



When you least expect it, **ZAP!!!**



In a few millionths of a second, common electrical surges and spikes can enter your data processing equipment and cause memory loss, false logic and misregistration. Surges very often do permanent damage to microcircuitry.

FLEXIDUCT Surge Suppressors catch surges and spikes before they have a chance to enter your equipment. In billionths of a second (Nanoseconds), **FLEXIDUCT** Surge Suppressors dissipate surges and spikes from any side of the line (most protect only one side).

Model FS-P plugs into the wall outlet to protect that outlet **and all other outlets on that circuit**. For safety, it is fused to protect from overloads.

No computer should be without the protection of a **FLEXIDUCT** Surge Suppressor...**especially yours!** Write or call for further information. Available from office products retailers.

FLEXIDUCT® Surge Suppressors

a product of Winders & Geist, Inc. P.O. Box 83088 Lincoln, NE 68501 402/474-3400

D&N MICRO PRODUCTS, INC.

3702 N. Wells St.
Fort Wayne, Ind. 46808
(219) 484-6414

TERMS \$3.00 shipping. Foreign orders add 15%, Indiana residents add 5% sales tax.

COMPUTER

MICRO-80 COMPUTER

Z-80A CPU with 4Mhz clock and CP/M 2.2 operating system. 64K low power static memory. Centronics parallel printer port. 3 serial ports. 4" cooling fan. Two 8" single or double sided floppy disk drives. IBM single density 3740 format for 243K of storage, double density format for 604K of storage. Double sided drives allow 1.2 meg on each drive. Satin finish extruded aluminum with vinyl woodgrain decorative finish. 8 slot backplane, 48 pin buss compatible with OSI boards.

MODEL 80-1200 \$2995
2 8" Single sided drives
MODEL 80-2400 \$3495
2 8" Double sided drives

MICRO-65 COMPUTER

6502 CPU with 2Mhz clock and DOS-65 operating system. 48K of low power static memory. 2 serial ports and 1 Centronics parallel port. 2 8" single or double sided drives. Satin finish extruded aluminum with vinyl woodgrain finish. 8 slot backplane, 48 pin buss compatible with OSI. Will run OSI 65D and 65U software. Includes Basic E/65 a compiled BASIC for 6502 CPU.

MODEL 65-1 \$2995
2 8" Single sided drives
MODEL 65-2 \$3495
2 8" Double sided drives

BP-580 8 Slot Backplane \$ 47
OSI 48 pin Buss compatible

MEM-CM9 MEMORY/ FLOPPY CONTROLLER

24K memory/floppy controller card uses 2114 memory chips, 1 8K and 1 16K partition. Supports OSI type disk interface

24MEM-CM9 \$325
16MEM-CM9 \$260
8MEM-CM9 \$180
BARE MEM-CM9 \$ 50
Controller on assembled unit add. \$ 90

BIO-1600 Bare IO card \$ 50
Supports 8K of memory, 2 16 bit parallel ports, 5 serial ports, with manual and Molex connectors.

PRINTERS

Okidata

ML82A, 120 cps, 10" \$409
ML83A, 120 cps, 15" \$895
ML84 Parallel, 200 caps, 15" \$1150
C. Ioth

8510AP Prowriter, parallel \$419
120 cps, correspondence quality
8510APD Prowriter, serial \$585
F10-40PU Starwriter, parallel \$1319
Letter quality daisy wheel
F10-40RU Starwriter, serial \$1319
F10-55PU Printmaster \$1610
parallel, Letter quality daisy wheel
F10-55RU Printmaster, serial \$1610

DISK DRIVES AND CABLES

8" Shugart SA801 \$385
single sided
8" Shugart SA851 \$585
double sided
FLC-66 ft cable from D&N \$69
or OSI disk controller to 8" drive
5 1/4" MPI B51 disk drive with \$450
cable, power supply and cabinet. Specify computer type.
FLC-5 1/4 cable for connection \$75
to 5 1/4" drive and D&N or OSI controller, with data separator and disk switch. Specify computer type

HARDWARE

OSI COMPATIBLE

IO-CA10X Serial Printer Port \$125
Specify Device #3 or #8
IO-CA9 Parallel Printer Port \$150

CMOS-MEM

64K CMOS static memory board, uses 6116 chips, 3 16K, 1 8K and 2 4K blocks, Partitionable for multi-user, OSI type disk controller, 2 IO mapped serial ports for use with D&N-80 CPU. Ideal way to upgrade from cassette to disk.

64K CMOS-MEM \$500
48K CMOS-MEM \$405
24K CMOS-MEM \$260
16K CMOS-MEM \$210
BARECMOS-MEM \$ 50
Controller add. \$ 90
2IO mapped serial ports add. \$125
on assembled memory board
Z80-IO 2IO mapped serial \$160
ports for use with D&N-80 CPU card
FL470 Disk Controller \$155
5 1/4" or 8" drive

STANDARD CP/M FOR OSI

D&N-80 CPU CARD

The D&N-80 CPU allows the owner of an OSI static memory computer to convert to Industrial Standard IBM 3740 single density disk format and CP/M operating system. Double density disk operation is also supported for 608K of storage on an 8" diskette. When used with a 5 1/4" disk system 200K of storage is provided. Optional parallel printer and real time clock. Also available for polled keyboard and video systems. Compatible with C2, C3, C4 and 200 series OSI computers.

INCLUDES CP/M 2.2

D&N-80-1 Serial 8" disk	\$595
D&N-80-2 Video 5 1/4" disk	\$595
D&N-80-3 Video 8" disk	\$595
Option 001	\$ 60

Parallel printer and
real time clock.

HARD DISK DRIVER

\$140

Allows D&N-80 CPU board to control OSI 40 or 80 meg hard disk unit. Will not destroy OSI files. Will also allow for a true 56K CP/M system. Specify 40 or 80 meg drive.

BUSS TRANSFER

\$135

Allows for D&N-80 and OSI CPU to be in the computer at the same time. Toggle switch provides for alternate CPU operation.

DISK TRANSFER

\$100

Utility program to transfer OSI CP/M format disk to IBM 3740 single density format. Will also transfer IBM to OSI format.

SYSTEM HARDWARE

REQUIREMENTS

D&N-80 CPU, D&N FL470 or OSI 470 controller, 48K memory at 0000-BFFF, 4K memory at D000-DFFF, two disk drive cables.

FORMAT TRANSFER

\$15

You supply software on 8" diskette D&N will transfer OSI CP/M format to IBM 3740 CP/M format. Can also transfer IBM 3740 CP/M format to OSI CP/M format. Original diskette returned.

Software Catalog

Commodore

Five new programs are available for CBM/PET and Commodore 64 computers. **Script Ease (\$39.50)** is a 40-column word processor designed for all levels of word processing needs. Text can be output to the printer without any format commands. These commands can be added in subsequent lessons. Requires disk drive, printer, and 32K in the CBM/PET. A \$5.00 demo is available (refundable).

Datalog (\$39.50) lets you define up to 12 of your own fields and creates up to 1000 records on a 4040 disk, each record being over 200 characters long. Interfaces to popular word processors for printing form letters or labels. Multiple sort and search capabilities. Same requirements as Script Ease. A \$5.00 demo is available (refundable).

Date Due (\$39.50) manages overdue items in libraries. It prints reports by name, date, call number, title, or room number.

Operates in 16K, 32K, or the "64". Requires disk drive and a printer is preferred. **Multiple Choice (\$29.50)** creates up to 150 question and answer sets per disk file. Any number of questions can be selected from the bank and randomized if desired. The answer choices are always in random order. A test can be taken on screen or printed on paper. An answer key is printed down the left side of the paper. Supplied on disk only but can be saved and used on tape. Provides high security for teacher made tests. Runs in 16K, 32K, and the "64".

Ledger (\$29.50) is a financial package for personal finance or school revolving accounts. It prints reports sorted by journal, ledger, or check register and handles up to 300 transactions in any number of accounts. It runs in 16K, 32K, or on the C64.

For more information contact Midwest Software, Box 214, Farmington, MI 48024, 313-777-1877.

Atari 800 Utility Cartridge

Monkey Wrench II is a ROM cartridge that plugs into the right-hand slot of your Atari 800. It provides 18 new BASIC commands and 16 machine-language commands. The new BASIC commands include - auto line numbering, renumber lines, delete range of lines, display all BASIC variables and values, scrolling up or down, find string, exchange string, copy lines, move lines, display disk directory, cursor exchange (no shift key needed), upper case lock, hex conversion, decimal conversion, and format program list (separates and prints to the screen or printer each command appearing on a BASIC multiple command line).

Price is \$59.95. For more information contact Eastern House Software, 3239 Linda Drive, Winston-Salem, NC 27106; (919) 924-2889.

Inventory Management for the Commodore 8032

INFOTORY, an inventory management system now available for the Commodore 8032 Professional Computer, offers an item capacity of 4,000 inventory items with 38 fields of information for each item, including three pricing levels. **INFOTORY** provides users with information reporting capabilities through its data management sub-system, **ANYREPORT**. **ANYREPORT** allows users to design reports based on information associated with their inventory and the option to save those reports for future use.

Suggested retail price is \$425.00. For more information contact S.S.R. Corp., 1600 Lyell Ave., Rochester, NY 14606; (716) 254-3200.

ATTENTION PROGRAMMERS!

At last! **Microscreens**, a screen generator package lets you produce clear, uncluttered, professional quality monitor screen formats... for only \$119.00. Just a few lines of code in your BASIC is all it takes. Develop selection menus, data-entry, inquiry display and more... quickly and easily... because **Microscreens**:

- provides configuration routines for monitor control characters. Permits use on any monitor.
- provides a "DRAW" program. Enables programmer to create any screen format on a blank screen.
- provides protected, unprotected and variable use fields.
- provides editing of input to data-entry screens and full data validity checking.
- provides highlighting and reverse video features usage (when available on your monitor).
- lets you position the cursor at the begin-
- ning of any data input field.
- provides six different escape codes for help, emergency stop or any other abnormal complication of input.
- can be INCLUDE'd in CP/M® BASIC compiled programs or MERGE'd with the **MICROSOFT® BASIC Interpreter** for Apple II with Softcard®.
- 3 K memory for screen handling routines; frequently less than your own code for monitor input/output.
- is a maximum flexibility screen generator. Reduces your programming time as much as 40%.

ORDER NOW. \$119.00

Please send my **Microscreens** program so I can begin to get quick and easy professional quality monitor screens. Only \$119.00.

Name _____

Address _____

City, State, Zip _____

Phone _____

MC/VISA _____ Exp. date _____

Circle one

CBASIC Compiler MBASIC Compiler

CB80 Compiler MBASIC Interpreter

Basic-80 Compiler Apple CP/M

©Apple II™ of Apple Computer, Inc., Microsoft, MBASIC™ of Microsoft, Inc., CP/M™ of Digital Research, Inc.



PMI, Incorporated
P.O. Box 87
Buckfield, ME 04220
(207) 336-2500

DEALER INQUIRIES INVITED

Programmer Utilities for Atari

AiDE (Absolute Disk Editor) for the Atari is a menu-driven system to simplify the disk management task. **Telecom** is a communications package that allows the Atari 400/800 to communicate with any and all other computers.

AiDE is \$29.95, **Telecom** is \$69.95. Both systems run on the Atari 400/800 home computer. Available from Roklan Corporation, 3335 N. Arlington Heights Road, Arlington Heights, IL 60004.

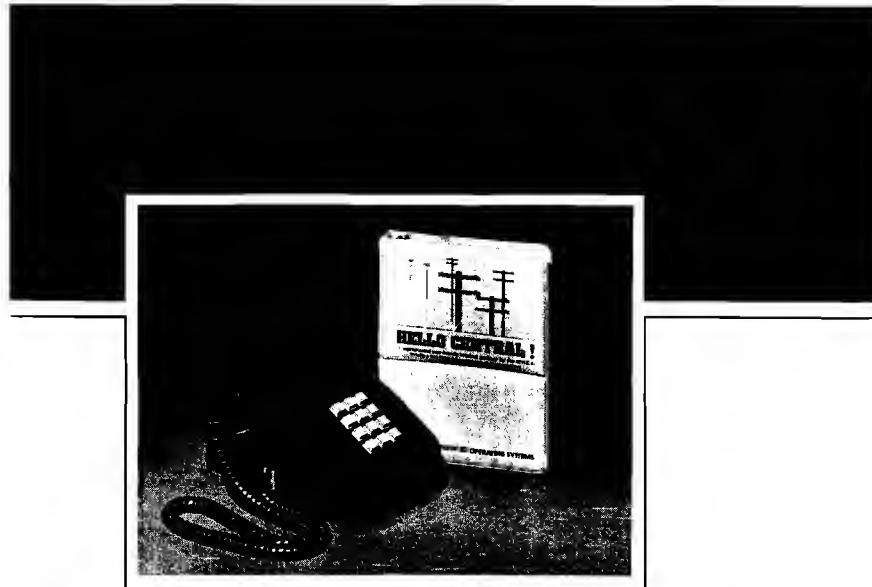
In Search of the Most Amazing Thing

In Search of the Most Amazing Thing, a combination adventure, strategy and arcade game, is designed to create an environment in which children are experiment and discover. The game places the child into a fantasy adventure where he/she must employ strategy and learning skills to discover the location and identity of The Most Amazing Thing.

Children will learn decision making and organizing, note taking and writing, map reading, trading and bargaining, music writing and drawing, and exploration.

In Search of the Most Amazing Thing is compatible with Apple, Atari, IBM, and Commodore 64 computers. Price is \$39.95.

(Continued on page 111)



HELLO CENTRAL!

The single most important telecommunications program available today . . .

"The most satisfying feature of **HELLO CENTRAL!** is its user-friendliness. . . offers some features that have been longed for in a terminal program. . . **HELLO CENTRAL!** is a great terminal program. . . consider this one."

—*SOFTALK (December, 1982)*

"The manual is relatively easy to read. . . Most directions, choices, and commands are either easy to remember or are displayed on the screen. . . In my opinion, the best feature. . . is the text editor. It allows you to write, insert, delete, and copy blocks of text in a very efficient manner. . . can receive and store text files written in Integer. . . Applesoft® BASIC and in Binary Code. . ."

—*DESKTOP COMPUTING (December, 1982)*

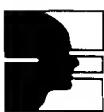
Here are a few of the features standard with **HELLO CENTRAL!**

- 18,000 character buffer to store an unlimited number of lines, regardless of length
- No need for 80-column hardware, because internal wordwrap eliminates split words
- Auto dial/answer and take-a-message
- Accepts any ASCII file
- Upper and lower case input and output
- Multiple user-defined directories
- Powerful text editor lets you modify incoming and outgoing information
- Not copy-protected, allowing for easy back-up
- Completely menu-driven
- Program updates (when available) via modem

Ask for No. 26081 only \$99.00

Only **HELLO CENTRAL!** has all of these features for \$99.00! Call 800-428-3696 or 317-298-5566 and ask for Operator 402.

Available for Apple II® series computers, including the new IIe®.
Apple II, II-PLUS, IIe, and Applesoft are registered trademarks, of Apple Computer, Inc.



SAMS BOOKS & SOFTWARE
HOWARD W. SAMS & CO., INC.
4300 West 62nd Street P.O. Box 7092
Indianapolis, IN 46206

computer mail order

Computer
Hardware
Software
Components
Peripherals
Accessories

PRINTERS SMITH CORONA

Call on \$50.00 Factory Rebate!
TP-1 \$499.00
Tractor Feed \$129.00
Ultrasonic 1 Typewriter \$439.00
C.I.TOH(TEC)

GX-100 \$209.00
Prowriter 8510P \$379.00
Prowriter 8510S \$579.00
Prowriter 1550P \$899.00
Prowriter 1550S \$749.00
Stenewriter F10-40 \$1259.00
Printmaster F10-55 \$1849.00

OKI DATA

82A CALL
83A CALL
84 (Parallel) CALL
84 (Serial) CALL
92 CALL
93 CALL
IOS

MicroPrism \$649.00
132 (Fully Configured) \$1599.00
80 (Fully Configured) \$1399.00
Cell for other configurations

STAR

Gemini 10 \$349.00
Gemini 15 \$489.00
Serial Board \$75.00

DAIBYWITER

2000 (Letter Quality) \$1049.00

Tractor Feed \$109.00

DIASLO

620 \$999.00

630 \$1789.00

TeleVideo



TERMINALS

910 \$559.00
912C \$889.00
920C \$739.00
925C \$719.00
950 \$929.00

COMPUTERS

800A \$1259.00
802 \$2849.00
802H \$4895.00
806/20 \$4949.00
818/40 \$8999.00
803 \$1949.00
1802G \$3399.00
1803 CALL

NEC

COMPUTERS

6000 CALL
8001A \$719.00
8031 \$719.00
8012 \$549.00

PRINTERS

8023 \$419.00
7710/7730 \$2249.00
3510/3530 \$1549.00

MONITORS

JB-1280 \$119.00

JB-1201 \$149.00

JC-1212 \$299.00

EAGLE

Call on Eagle 8 Bit & 16 Bit
Computers & Software

MODEMS

HAYES

Smart \$219.00
Smart 1200 (1200 Baud) \$49.00
Chronograph \$199.00
Micromodem 100 \$309.00
Micromodem 11 \$279.00
Micromodem 11 (with term) \$299.00
Smart Com II \$99.00

NOVATION

J-Cat \$119.00
Cat \$144.00
D-Cat \$159.00

<div data-bbox="327 349 \$499.00</div>
<div data-bbox="327

FREE!

A six-pack of tasty Apple** posters!

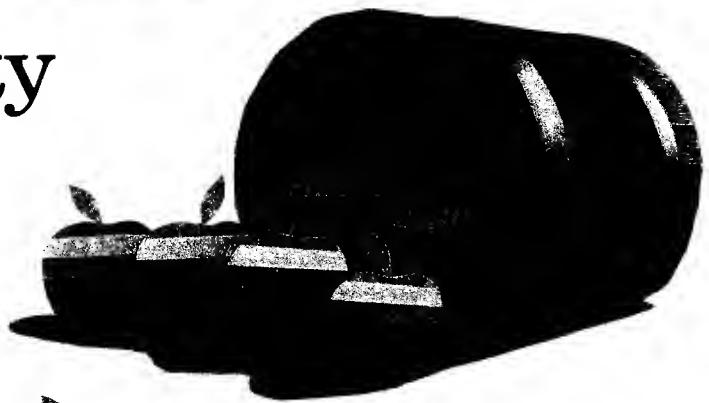


*Look for this poster display
at your computer store.*



*The posters are exclusive products of Datamost, Inc. and are not connected with, or authorized by Apple Computer, Inc.

**Apple is a trademark of Apple Computer, Inc.



Here's your chance to get any or all of these beautiful 16 x 24 posters **Free!** except for just a small postage/handling charge! Commissioned by Datamost, and painted by well-known computer artist, Art Huff, each is a unique experience in design that will grace your home or office.

To get your posters, visit your favorite computer store and pick up a coupon where you see the counter display shown below. Fill out the coupon and mail it to Datamost. For each individual poster you want **Free**, include a registration card from any Datamost software package. Send only \$1.75 postage/handling fee with each order. (Note. Without a Datamost registration card, the Posters are available at only \$5.95 each, plus same postage/handling charge.)

Be the first to collect the entire series of these magnificent exclusive, and **FREE** Apple* posters from Datamost!

DATAMOST™

8943 Fullbright Ave., Chatsworth, CA 91311. (213) 709-1202
Copyright 1983 Datamost Inc.

YES! I Want To Participate in the Datamost FREE APPLE* POSTER OFFER

Please sign us up and send me a complimentary set of the Six full color Apple Posters.

I would like: window banners.

counter cards w/coupons.

Name: Title:

Store/Business Name:

Address:

City: State: Zip:

Mastercard Visa No.

DATAMOST™

8943 Fullbright Ave., Chatsworth, CA 91311 (213) 709-1202

Software Catalog (continued)

Electronic Report Card

The Report Card, for the Apple, tracks the progress of up to 300 students per diskette. The program calculates student and class averages and ranks students within their class. Exercises, quizzes and tests can be individually weighted for their effect on the final grade. The manual includes a reference section and a tutorial for ease of use.

Price is \$60.00 available from Sensible Software, 6619 Perham Drive, W. Bloomfield, MI 48033; (313) 399-8877.

Physics Packages for the Apple

Harmonic Motion Workshop, Projectile Motion Workshop, and Charged Particle Workshop are the first three in a series of packages being developed by a former college Physics professor. The Harmonic Motion Workshop visually presents the concepts associated with harmonic motion by use of high-resolution graphics. The student can alter such variables as the phase, amplitude, and damping factor and immediately see the effect. Projectile Motion Workshop is designed to illustrate projectile motion under the influence of a uniform force of gravity.

In this program, the user may control the projectile's initial velocity and its angle of fire. Charged Particle Workshop simulates the motion of a charged particle under the influence of various combinations of electric and magnetic fields. Uniform electric field, uniform magnetic field and crossed electric-magnetic field are illustrated.

The packages require a 48K Apple with Applesoft in ROM and Disk II. Price is \$75.00 each. Available from your local computer retailer or High Technology Software Products, Inc., 1611 N.W. 23rd Street, P.O. Box 60406, Oklahoma City, OK 73106, (405) 525-4359.

Serpent Game for Atari

In **Serpentine** for the Atari 400/800, giant serpents set forth to slay their slithery cousins. The snakes lay eggs and fight ferociously to protect their young. A fast arcade-style game with five maze configurations and many levels of play.

Price is \$39.95. Available from Broderbund Software, Inc., 1938 4th St., San Rafael, CA 94901; (415) 456-6424.

Apple Tax Planner

Tax Planner helps minimize personal tax liability through year-round planning. The pro-

(continued on page 112)

AIM + POWER COMPUTECH

from

All prices
Postpaid
(Continental
U.S. —
otherwise
\$2 credit)



Check the
outstanding
documentation
supplied with
AIM65

Top quality power supply designed to Rockwell's specs for fully populated AIM 65 — includes overvoltage protection, transient suppression, metal case and power cable:

PSSBC-A (5V 2A Reg; 24V .5A Avg, 2.5A Peak, Unreg) ... \$64.95
Same but an extra AMP at 5 volts to drive your extra boards:
PSSBC-3 (5V 3A Reg; 24V .5A Avg, 2.5A Peak, unreg) ... \$74.95

The professional's choice in microcomputers:

AIM65/1K RAM \$429.95 BASIC (2 ROMS) \$59.95
AIM65/4K RAM \$464.95 ASSEMBLER (1 ROM) .. \$32.95
FORTH (2 ROMS) \$59.95.

SAVE EVEN MORE ON COMBINATIONS

AIM65/1K + PSSBC-A . \$479.95 AIM65/4K + PSSBC-3 . \$524.95

We gladly quote on all AIM65/40 and RM65 items as well.

ORDERS: (714) 369-1084

P.O. Box 20054 • Riverside, CA 92516
California residents add 6% sales tax



Circle No. 79



5130 East Charleston Blvd
Suite 4M

Las Vegas, Nevada 89122

Add \$3.00 for shipping, handling and insurance.
Nevada residents add 5.75% sales tax. Please include
phone number

Equipment subject to price change and availability.
Call or write for price list.

Circle No. 80

gram is designed for tax practitioners, estate planners and attorneys, plus banks and trusts who do income tax projections for clients. The Planner helps build client data bases for use during subsequent tax seasons and in serving more clients. Individuals who do their own financial planning will also find the Planner helpful.

User-modifiable parameter files for each year permit long-range tax-planning options. Up to four client data files can be handled at once — the first to hold current data, additional files to reflect assumed data changes. Up to four different assumption data

files for a given year and tax calculations for four different years can be programmed.

Tax Planner cost is \$300.00 available from CPAids, 1061 Fraternity Circle Drive, Kent, OH 44240; (216) 678-9015.

Commodore Products

The 64-RABBIT is a high-speed cassette interface on ROM cartridge that adds 12 commands to BASIC. The new RABBIT save, load, and verify commands operate five times faster than the normal BASIC commands. Other commands include load

run, test memory, decimal to hexadecimal conversion, hex to decimal conversion, and more.

RABBITS are also available for the VIC-20 and PET 4001, 8001, and 8032. Price is \$39.95.

MAE (Macro Assembler and Text Editor) is a professional development tool based on the well-known Apple, PET-, and ATARI-MAE. Features include: 38 error codes, 27 commands, 26 pseudo ops, and 5 conditional assembly operators, built-in software UART (110-9600 baud), and macro, conditional assembly, and interactive assembly capability.

Text editor features in-

clude autoline numbering, find, exchange string, copy, move, renumber, delete lines, and append. Word processor features include right and left justify, center, set margins, define text body shape, headers, and footers.

All MAEs are priced at \$99.95.

Our Software and hardware catalogs list the newest and most pertinent products on the market. The easy-to-read entries offer quick information for our readers. Use these catalogs to present your products. Send your press releases to: MICRO INK P.O. Box 6502 Amherst, NH 03031



Leap into
a new
dimension
with
Aztec C!

C COMPILERS—COMMON FEATURES:

- UNIX VER 7 compatibility • standard float, double, and long support • run time library with full I/O and source • fast compilation and execution • full language.

AZTEC C II CP/M (MP/M) \$199

- produces relocatable 8080 source code • assembler and linker supplied • optional M80 interface • SID/ZSID debugger interface • library utility • APPLE requires Z80 and 16K card

AZTEC C II APPLE DOS \$199

- relocating assembler supplied • APPLE SHELL • VED editor • library and other utilities • requires 16K card

C86 IBM PC MSDOS CP/M-86 \$249

- directly produces 8088/8086 object code • linker supplied

Manuals—\$30 ORDER BY PHONE OR BY MAIL—Specify products and disk format

MANX
software systems

Box 55, Shrewsbury, N.J. 07701 (201) 780-4004



CP/M FORMATS: 8" STD HEATH, APPLE, OSBORNE, NORTHSTAR. OUTSIDE USA—Add \$10. In NJ add 5% sales tax



TO ORDER:

P. O. BOX 18765
WICHITA, KS 67218
(316) 263-1095

Personal checks accepted
(Allow 3 weeks) or
C.O.D. (Add \$2)

Handling charge \$2.00

VIC-20® is a registered trademark of Commodore



Circle No. 82

Micro™

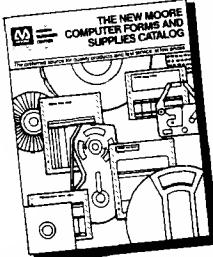
New Publications

The Small Computer Connection , by Neil L. Shapiro. A Micro Text/ McGraw-Hill Copublication, 1221 Avenue of the Americas, New York NY 10020, 1983, 190 pages, paperback ISBN 0-07-056412-4	992 pages, Hard cover ISBN 0-7-027972-1	\$79.50
Intermediate-Level Apple II Handbook , by David L. Heiserman. Howard W. Sams & Co., Inc., 4300 West 62nd St., Indianapolis, IN 46268, 1983, 324 pages, paperback ISBN 0-672-21889-5	6502 Assembly Language Programming, by Judi N. Fernandez, Donna N. Tabler, & Ruth Ashley. John Wiley & Sons, Inc., 605 Third Ave., New York, NY 10158, 1983, 277 pages, paperback ISBN 0-471-86120-0	\$12.95
The World Connection , by Timothy Orr Knight. Howard W. Sams & Co., Inc., 4300 West 62nd St., Indianapolis, IN 46268, 1983, 142 pages, paperback ISBN 0-672-22042-3	BASIC Exercises for the Atari , by J.P. Lamontier. SYBEX, 2344 Sixth Street, Berkeley, CA 94710, 1983, 251 pages, paperback ISBN 0-89599-101-2	\$12.95
The McGraw-Hill Computer Handbook , by Harry Helms. McGraw-Hill Book Company, 1221 Avenue of the Americas, New York, NY 10020, 1983,	Doing Business with PASCAL , by Richard Hergert & Douglas Hergert. SYBEX, 2344 Sixth Street, Berkeley, CA 94710, 1983, 371 pages, paperback ISBN 0-89599-091-1	\$15.95
		plus \$1.50 S/H

MICRO

IT'S FREE!

Announcing the NEW, Summer 1983 Moore Computer Forms and Supplies Catalog



Now with a NEW 34-page computer forms section!

- Our new, 80-page Summer Catalog features more than 800 quality, brand-name products—all guaranteed to meet your 100% satisfaction or your money back
- For all your computer or word processor needs, a wide selection of magnetic media, disk storage, binders, ribbons and furniture
- Over 40 pages of multi-purpose computer forms and labels at low prices, including an ALL-NEW 34-page section of imprinted forms
- Unmatched customer services, like fast order processing, custom imprinting, emergency overnight delivery, plus exclusive toll-free Technical Product Assistance

Mail this coupon or call toll-free
1-800-323-6230
 (In Illinois, Call (312) 459-0210)



Catalog Group
MOORE
BUSINESS
CENTER

A Division of Moore Business Forms

P.O. Box 20
 Wheeling, IL 60090
 Dept. 123411

YES! Send me a FREE 80-page, full-color copy of the Summer 1983 Moore Catalog

YOUR NAME _____ TITLE _____ BUSINESS PHONE _____

COMPANY NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

COMPUTER MAKE AND MODEL _____

TYPE OF BUSINESS _____ NO. OF EMPLOYEES _____

AIM GRAPHICS

Now you
 can have full-color,
 high-resolution graphics
 for your Rockwell
 AIM computer.

You get:

- 16 colors
- Text
- 192 x 256 Pixels

AIM Graphics includes its own 16K dynamic RAM memory, and uses no system RAM.

You get AIM Graphics, start-up software and data pack for \$175.00.

Call or write today to order or get more information.

Rockwell AIM is a trademark of Rockwell, International

DESIGN DYNAMICS

1830 Soscol Avenue
 Napa, California 94559

Yes! I want AIM Graphics!

Name: _____

Firm: _____

Address: _____

City: _____ St _____ Zip _____

For immediate response, call now:
 (707) 257-6000

Circle No. 84

113

Hardware Catalog

Atari Speech Synthesizer

VOICE BOX II for ATARI 400/800 computers requires a 32K disk system. It offers many features, including the abilities to speak with inflection, to speak in foreign languages with correct foreign spelling as input, and to sing with voice and 3-part music.

VOICE BOX II contains a library of 30 famous songs and a comprehensive music system that allows you to enter new songs easily.

Software provided can convert the bottom two rows of the Atari keyboard into a piano with a range of 3½ octaves using the shift and control keys. You can also have programmable musical sound effects such as tremolo, vibrato, and glissando.

Price is **\$169.00**. For more information, contact The Alien Group, 27 West 23rd Street, New York, NY 10010; (212) 741-1770.



Voice Box II for ATARI
Speech Synthesizer with Singing and Inflection

Z80 Card for the Apple IIe

The new Premium SoftCard II from Microsoft Corporation fits into the video slot of the Apple IIe and apparently will double many of the standard features of this new 8-bit personal computer.

The Z-80-based card comes with the CP/M 80 operating system, giving users access to the broad range of applications programs available for the 8-bit microcomputer world. It will also give access to software development tools not developed specifically to work with Apple DOS. Once installed, the user will specify which operating system by booting the appropriate Z80 or 6502A disk.

The card features 64K of random access memory, doubling the amount of memory standard with the Apple IIe. In addition, the card allows for an 80-column display.

Two versions of Microsoft's BASIC language interpreter are included. MBASIC supports the low-resolution graphics and GBASIC supports both the low- and high-resolution graphics.

Color Computer Keyboard

SUPER-PRO replacement keyboard kit for TDP-100 and Radio Shack Color Computers offers complete compatibility and operator convenience.

Price is **\$69.95**. An additional plug adapter, priced at **\$4.95**, is required when upgrading computers manufactured after approximately October, 1982.

Available from dealer or Mark Data Products, 24001 Alicia Parkway, No. 226, Mission Viejo, CA 92691..

Retail price for the card is **\$495**. It comes complete with 300 pages of documentation including CP/M and Microsoft BASIC Quick Reference Guides, and the Osborne tutorial for CP/M.

For more information contact Microsoft, 10700 Northupway, Bellevue, WA 98006, (206) 828-8080.

Epson FX-80 Printer

The **Epson FX-80**, a high-performance bi-directional printer, combines a printing speed of 160 characters-per-second with features that provide sophisticated printing for a wide range of applications.

The FX-80 offers a software-selectable choice of elite (12 cpi) or pica (10 cpi) print spacing. In addition, users can send their own special fonts from their computer system to the printer, downloading the font into the printer's memory.

Other features include a one-to-one graphics ratio and a 2K-byte buffer, which allows buffered printing on longer productions. The FX-80 provides 9x9 dot-matrix characters with full descenders and is downward compatible with the Epson MX Series of printers. It offers proportional spacing, pin- and friction-feeds, and a standard parallel communications interface, with serial or IEEE 488 interfaces also available as options.

Normal, emphasized, bold and double-emphasized printing densities provide flexibility.

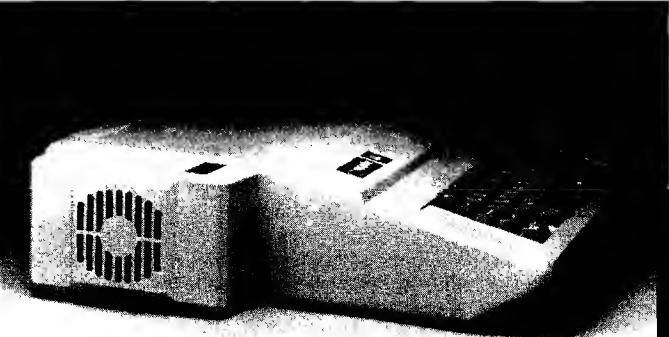
Price is **\$699.00**. Available through Epson retailers. For more information contact Epson America, 3415 Kashiwa Street, Torrance, CA 90505; (213) 539-9140.

Atari I/O Package

The MOSAIC I/O Package can help give the ATARI computer direct ties to the real world. The four ports on the front of the ATARI computer connect directly to a PIA for use as output as well as input ports. Now ATARI owners can build custom program controllers, interface to home control circuits, or use any hardware the imagination can devise.

The I/O Package comes with four, nine-pin connectors, four, twenty-four-inch lengths of nine conductor ribbon cable, and complete documentation for their use.

Order number H-309, Price \$18. Available from Mosaic Electronics, P.O. Box 748, Oregon City, OR 97045.



The Kensington System Saver Power Control

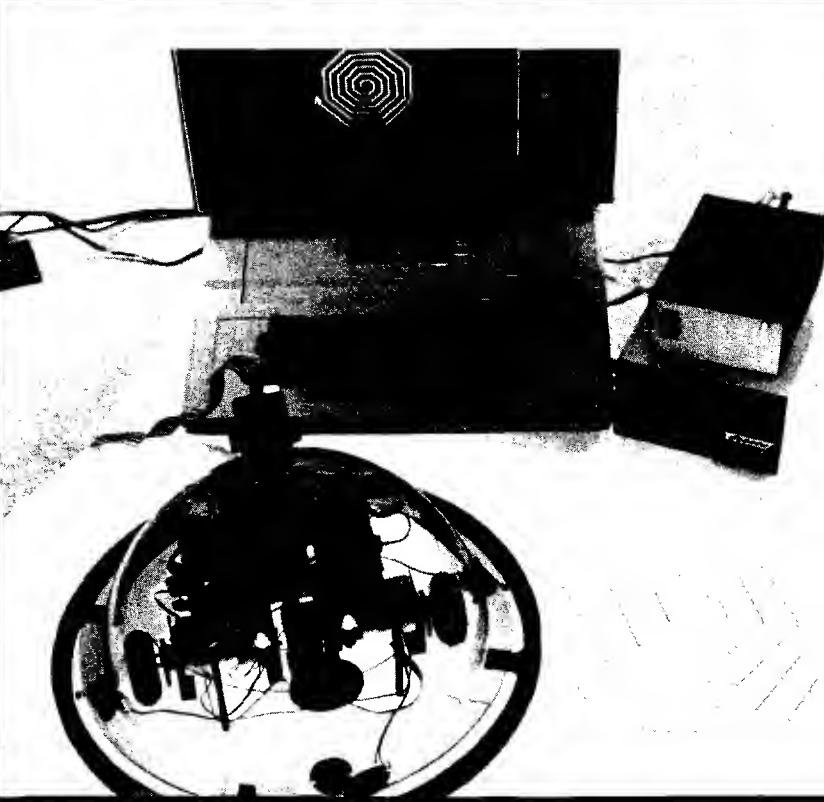
Power Control for the Apple

Apple owners' high-tech power line problems are being solved a design approach that most electrical engineers would view as low tech using technology that has existed for decades. But the circuitry used in the company's UL-listed **System Saver** power control and protection accessory is effective and reliable, and inexpensive.

System Saver attaches to any Apple II, Apple II+, or Apple IIe, with or without an Apple monitor stand in

place. It replaces the Apple power cord, providing simultaneous control and protection to the Apple computer, itself, to one or two accessories plugged into auxiliary outlets (rated at 8 Amps total) on the back of the System Saver case, and into built-in cooling fan.

Price is \$89.95. For more information contact Kensington Microwave, Ltd., 919 Third Ave., New York, NY 10022; (212) 476-7707.



The **Tasman Turtle**, a programmable robot, is available for the Apple II or other parallel interface micros as well as those with an RS-232 interface. All turtles can move and turn, toot their horn, blink their eyes, draw with a pen and "feel" through touch sensors.

A talking version of Tasman comes with a basic vocabulary of 150 words, expandable to more than 600 words. Another option is an electronic compass that indicates directional change.

Prices begin at \$999.95. For more information contact Harvard Associates, Inc., 260 Beacon Street, Somerville, MA 02143; (617) 492-0660.

*The Tasman Turtle
interfaced to an Apple II*

SOFTWARE FOR THE HARDCORE

THE PROFESSIONAL'S CHOICE FORTH — A Tool for Craftsmen!

It has been said that if Chippendale had made programs he would have used FORTH as his tool. If you want to learn how to program, use a teaching language—PASCAL or BASIC. If you know how to program, use a language designed for craftsmen—FORTH.

FORTH Systems

For all FLEX systems: 6800 & 6809. Specify 5" or 8" diskette and hardware configuration. For standalone versions, write or call.

** tFORTH—extended fig-FORTH (1 disk)	\$100 (\$15)
** tFORTH +—extended more! (3 5" or 2 8" disks)	\$250 (\$25)
tFORTH + includes 2nd screen editor, assembler, extended data types and utility vocabularies, GOING FORTH CAI course on FORTH, games, and debugging aids.	

TRS-80 COLORFORTH — 10K ROM Pack

Full screen editor. Will work on 4K, 16K, or 32K systems \$110 (\$20). Disk versions available.

Applications Programs

** firmFORTH 6809 tFORTH + only	\$350 (\$10)
For target compilations to rommable code. Deletes unused code and unneeded dictionary heads. Requires tFORTH +.	
** TINY PASCAL compiler in FORTH: 6800/09	\$75 (\$20)
** FORTH PROGRAMMING AIDS: Extensive debugging, decompiling, and program analysis tools.	\$150 (\$10)

Manuals alone, price in (). Add \$5/system for shipping. \$12 for foreign air.

Talbot Microsystems

1927 Curtis Ave., Redondo Beach, CA 90278

(213) 376-9941

(TM) tFORTH, COLORFORTH and firmFORTH are trademarks of Talbot Microsystems.
(TM) FLEX is a trademark of Technical Systems Consultants.

Circle No. 85

RAM

For ATARI
with Lifetime Warranty

64K Board	(400)	\$150
48K Board	(400)	\$115
32K Board	(400/800)	\$ 90
Real Time Clock	(800)	\$ 50
16K Board	(VIC-20)	\$ 80

FREE SHIPPING ANYWHERE IN U.S.A.

INTEC
PERIPHERALS
CORP

906 E. Highland Ave.
San Bernardino, CA 92404
(714) 881-1533



VIC-20 is a Trademark of Commodore, Inc.
ATARI, 400, 800 are Trademarks of ATARI, Inc.

MICROBITE

Enhanced OS650D 3.3 C1P-MF

Many new functions such as system commands for catalog control, 10 active files, end of file/end of volume processing, task storage, printout, file append, run time, file editors/editors command file processing, long string read command. Many more! \$30. Write for details. Ray Hydon, 20 Eastwood Dr., Grafton, OH 44144.

OSI C1P Word Processor

Fast Assembly Language Word Processor for 8K, Cassette-Based C1P or Superboard. Document storage on tape. Full screen edit. 8" Screens of text in 8K. Price: \$30. 16K version supports 8.3K with additional features. Price: \$35. Requires CIS Monitor ROM. Micro Chip's Software, 8104 NE 92nd Circle, Vancouver, WA 98660.

The Cheap Assembler

Includes unlimited length labels, free field programming, two pass RAM/disk based assembler, ten command text editor, interactive operation, tutorial manual and demonstration routines. APPLE II+ 48K, DOS 3.3 required. Send \$70.00 + \$4.00 P&H to: Thunders Software, P.O. Box 31501, Houston, TX 77231, 713/774-5501.

Franklin Color Adapter

There is no E-Z-ET method. Our assembled boards are an absolute must for your Franklin Acc 1000. No cutting, wiring, or soldering required. \$80.00 + \$2.00 S/H. N.Y. residents + 7% DISPLAY SYSTEMS/RESEARCH, 444 Front Street, Owego, NY 13827.

OSI Programs

Quality programs for all OSI systems. Games, Full Screen Editor, Machine Code Tracer. On tape or 5 1/4" or disk for C1, C2, C4 systems. Write for catalog. Available from DMP Systems or our many distributors. DMP Systems, 319 Hampton Blvd., Rochester, NY 14612.

Payroll

Compatible with 64K Apple computers. Features: 100 employees per disk, Time card adding, automatic overtime, User changeable taxtables, five miscellaneous deductions - fixed or percentage amounts, tips, automatic printing of checks, W-2 forms, and reports. Bill Martin, 6485 Diana Drive #2, Poland, OH 44514, (216) 757-2143.

OSI - Game Set 1

Two arcade games. Machine language (disk only) and Basic. Lunar Pro (Lunar Lander) with multiple screens, craft rotation, excellent graphics. Squeeze (ZAP) - defend your star castle. Frustrating Arcade graphics. Clpm1, Clpm2, Clp, 6.5K, \$5 cassette, \$12 disk ppd. Flewart, Suite 15c, 1150 Fifth Ave., New York, NY 10028.

AIM-65 Real Time Clock

Provides hour, minute, second, day of week, day, month, year, 12 or 24 hour format. Pin compatible with AIM expansion connector (also SYM, KIM). Four switch selectable interrupts. Nicad battery backup. Industrial quality board 4.5 x 6. All IC's socketed. Single 5V supply. 72 page manual. All software included. Bare board \$19. Complete A&T \$93, includes batteries. Add \$4 ship and handling. Calif residents add 6% DATA DESIGN GROUP, P.O. Box 3318, La Jolla, CA 92038, (619) 265-6940.

SPECTRUM PROJECTS

Basic Aid

"An excellent program and fine utility."

Rainbow Review - Aug. 82
Single control key input of BASIC commands. \$34.95

Spectrum Stick

"More like arcade joysticks than anything we've yet encountered."

Rainbow Review - Oct. 82
Response and control put the joy back in color computing. \$39.95

Spectrum Paddle

For quicker side-to-side action and higher scores. \$19.95

CALL NOW
212-441-2807
FOR FAST DELIVERY
All orders plus \$2 shipping

SEND TO
DEPT. C2 93-15 86TH DRIVE
WOODHAVEN, N.Y. 11421
NY residents add sales tax

Circle No. 87

OSI Disk Users

Double your disk storage capacity Without adding disk drives

Now you can more than double your usable floppy disk storage capacity—for a fraction of the cost of additional disk drives. Modular Systems' DiskDoubler™ is a double-density adapter that doubles the storage capacity of each disk track. The DiskDoubler plugs directly into an OSI disk interface board. No changes to hardware or software are required.

The DiskDoubler increases total disk space under OS-65U to 550K; under OS-65D to 473K for 8-inch floppies, to 163K for mini-floppies. With the DiskDoubler, each drive does the work of two. You can have more and larger programs, related files, and disk utilities on the same disk—for easier operation without constant disk changes.

Your OSI system is an investment in computing power. Get the full value from the disk hardware and software that you already own. Just write to us, and we'll send you the full story on the DiskDoubler, along with the rest of our growing family of products for OSI disk systems.

TM DiskDoubler is a trademark of Modular Systems.



Post Office Box 16C
Oradell, NJ 07649.0016
Telephone 201 262.0093

Modular Systems

Circle No. 88

HARDWARE AND SOFTWARE FOR THE

VIC 20® & COMMODORE 64®

Software

ZAP! - Climbing the corporate ladder could be fun except for all that falling paperwork. This HiRes arcade type game allows up to 4 players to advance through each floor to scale the corporate ranks. Be careful, it's easy to be ZAPPED! CARTRIDGE for VIC 20® \$29.95

ATE-PAK - Eight graphic games on tape with complete manual to explain gaming techniques. For VIC 20® ONLY \$24.95

Word Wizard For The VIC 20® - (Requires at least 8K memory expansion) A user friendly WORD PROCESSOR with optional joystick control. Easy edit and string manipulation commands. Full use of function keys. Delete Word, Search functions and Full Justification. Use VIC 20® printer, or any Centronics compatible printer connected to the user port. On Tape (supports disk). \$34.95

Bomber Word - A unique graphic word game on cartridge that provides the full thrill of arcade action. Complete with six modes of play options for added enjoyment. Play against the computer or another player. 6 to adult. For VIC 20® \$29.95

Tic Attack - A fast action arcade game on Cartridge that challenges all of your dexterity. Written in machine language for special audio & visual effects. Over 100 levels of play. High score indication. For VIC 20® \$29.95

Dot-A-Lot - As you wander through life collecting Berries, you happen upon some magical fruit. Pick one and the treasures appear, but the Meanies are out today looking to spoil your fun. Defeat them and continue on to a higher level. An ever changing maze plus arcade type animation to provide a real winning CARTRIDGE for the VIC 20® \$29.95

Triple Play - Three games that are both fun and educational. CROSSWORDS (requires at least 8K expansion). Five complete puzzles are included. CRYPTOSOLVE will help you solve those cryptic messages found in newspapers, and magazines with a systematic computer technique. Included are approximately 50 different puzzles. You can even enter your own cryptic messages. HIDDEN WORDS will display a matrix of seemingly random letters on the screen. You should be able to find many words. Included are approximately 25 different puzzles. For VIC 20® ONLY \$29.95 for all 3

KEYQUEST - Our exciting new Arcade type game that takes you through the many levels of an ancient dungeon while gathering treasures and gaining experience points. Monsters, magical keys, and hidden passages all add to the excitement. ON CARTRIDGE for VIC 20® ONLY \$34.95

SKETCH PAD & CHAR-GEN - A high resolution drawing program that will allow you to save your pictures to tape. Also included is a simple to use character generator that will allow you to design a different character for every printable key. Create game creatures, foreign alphabets, secret symbols or other special characters. One set is included. On tape for the VIC 20® \$24.95

Hardware

Expand-O-Ram - 16K Expansion Board for the VIC 20® with reset, memory write protect, full memory allocation, plus TWO slots. Like having 2 products in 1. Can be used as a cartridge development system. \$119.00

Universal Tape Interface & Duplicator - (Use on the Commodore 64® and VIC 20®). With this device, you can easily load, save or even duplicate tapes with your standard recorder. Full 3 LED indication of Data Transfer. A reliable way to Load, Save and Duplicate. NOTE: Duplication requires 2 standard cassette recorders. ONLY \$49.50

TYMAC BUFFERED PARALLEL CABLE WITH DRIVER - For the VIC 20® & Commodore 64®. This cable assembly plugs into the USER Port and provides a simple and inexpensive way to connect a PARALLEL Printer to your computer. ONLY \$19.95

DRIVER CARTRIDGE for VIC 20® - Take full advantage of the capabilities of your Parallel Printer including full Commodore graphics and formatting. Available for SEIKOSHA, C.I.T.O.H., OKIDATA, and others. Specify printer. ONLY \$29.95

TYMAC "CONNECTION" - A truly intelligent parallel interface for the VIC 20® and Commodore 64®. It will make your printer operate like the COMMODORE Printer including graphics, text symbols, tab's, and virtually every other printer function. Plugs into the serial socket. Available for most popular parallel printer. \$119.00



Dealer and Distributor
Inquiries Invited

201-638-9027

13428 Route 23, Butler, NJ. 07405

**MICRO
WARE**
DISTRIBUTING INC.

NOTE: We solicit hardware and software items for the VIC 20® and Commodore 64® Royalties, license fees, or outright purchases can be negotiated. Commodore 64® & VIC 20® are Registered Trademarks of Commodore Business Machines, Inc.

The
MIDNITE
SOFTWARE GAZETTE

The
PAPER

A Bi-Monthly Journal of Notes,
Reviews and Articles
Five Years of Service to the PET® Community



First
The Independent U.S. Magazine for
Users of Commodore Brand Computers

EDITORS: Jim and Ellen Strasma

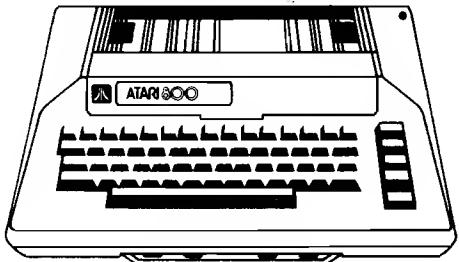
\$20 US / YEAR

Sample Issue free on request, from:
635 MAPLE, MT. ZION, IL 62549 USA
217/864-5320

Circle 90

OHIO COMPUTER CAMP

"GIVE YOUR CHILD A BETTER CHANCE
IN A CHANGING WORLD!"



One of the finest computer summer camps in the nation! Now in our third season, Atari Learning Center this year will offer complete recreational, cultural and social camaraderie in conjunction with Denison University. Full motel-resort facilities (swimming, sauna, tennis, etc.) and at least 6 hours every day of hands-on computer learning.

Spacious, comfortable rooms and meals at the college dorms. PLUS...mid-course weekend break at Kings Island and the fabulous Kings Island Resort Inn!

COMPARE OUR LOWER COST FEE structure before you send your child to any other camp. Reservations accepted now for two and four week sessions June 13 through August 5. Restricted to 40 co-ed students, ages 9-18, per session.

For Free information packet call:
614-454-6408 or 349-8448

or write to:
Mitey Byte Corporation
1325 Maple Ave., Zanesville, Ohio 43701

Circle No. 91

MICRO™

Reviews in Brief

Product Name: **Disk Data Handler**
Equip. req'd: TRS-80 Color Computer 32K Disk
Price: \$44.95 + \$1.00 Shipping
Manufacturer: Custom Software Engineering, Inc. (D-8)
807 Minutemen Causeway
Cocoa Beach, FL 32931

Description: *Disk Data Handler* is a database management system for the Color Computer. On-screen editing and high-speed record sort and selection is featured. The BASIC program with machine-language subroutines allows you to create fields and records that will fit your specific needs.

Pluses: The program is easy to learn and has powerful sort and select features. Both quick and extended files are available. Extended files are stored on disk and are retrieved by keyed quick files. Reports are easy to generate and report command files can be read that will format and print any desired report. The program will create files of selected data for additional processing by your BASIC programs.

Minuses: The disk-handling routines are not error trapped. Care must be used to specify correct file specifications otherwise the program will crash. The documentation does warn where this will happen. The report feature has many powerful aspects, but it lacks the ability to generate headings or pagination. No computation is possible in files.

Documentation: A 12-page instruction sheet is included that explains the operation of the program. Techniques of accessing and computing numeric data are included as is a Stock Tracker program.

Skill level required: A knowledge of data handling and file-creation techniques is helpful but not required.

Reviewer: John Steiner

Product Name: **Ultra 80CC**
Equip. Req'd: Color Computer with 32K memory
Price: \$49.95 (Disk only)
Manufacturer: Spectral Associates
141 Harvard Ave.
Tacoma, WA 98466

Description: *Ultra 80CC* is an old friend in disguise for many 6809 users; it is TSC's editor and 6809 mnemonic assembler, adapted for the Color Computer. This software is used on most 6809 systems running Flex, and this adaptation makes fully professional software available for Color Computer owners. The adaptation includes tape read and write from the editor and printer output for both modules. (I/O is normally furnished by Flex.) Both modules operate from command lines similar to those



used by most DOS packages, so the user who later upgrades to a DOS will already be familiar with this type of operator communication. The Editor is an exceptionally powerful content-oriented line editor with a full complement of edit, search, copy, and delete functions. Full mastery of the editor's capabilities will take some time, but simple editing is quickly learned. The assembler has full macro and conditional assembly capability and ten assembly-time options including print-format options. Source files should be produced by the editor, but tape files probably can be read by the editor and written to disk. Object code is returned to disk and then the file can be accessed by the Radio Shack DOS.

Pluses: Exceptional quality at a very low cost. Short learning curve to get started, with reserve power as the user learns more about the programs. Very smooth operation with Radio Shack DOS and various debugger programs.

Minuses: None noted; some similar products offer a debug monitor at the same price, but the quality in this package makes it a bargain.

Documentation: The manual includes over 100 pages devoted to use of the two programs, 6809 assembly-languages procedures, and addenda detailing the special features in the CoCo adaptation.

Experience level required: Some assembly language experience will ease the learning process, but a diligent beginner should be able to use this package to good advantage.

Reviewer: Ralph Tenny

Product Name: **Apple Mechanic**

Equip. req'd: Apple II, 48K

Price: \$29.50

Manufacturer: Beagle Bros.
4315 Sierra Vista
San Diego, CA 92103

Description: This new Apple utility contains a shape-defining/manipulating program, a disk zap program, and a collection of "two liners."

Pluses: The shape program includes several character set fonts that do not require any extra drawing code. The Applesoft DRAW command is entirely sufficient. The program for modifying fonts is without question the best available.

Minuses: Not many. Perhaps the manufacturer should have used examples of greater educational value in the "Byte Zap" program user's manual.

Documentation: Well written, informative, and entertaining.

(continued)

BASF DISKS

LIFETIME
GUARANTEE

HUB-RINGED

CERTIFIED
ERROR FREE

SSDD

5 1/4"

DSDD

\$21.90 ea. — 1-9 Boxes — \$30.90 ea.
\$19.90 ea. — 10+ Boxes — \$28.90 ea.

FREE PLASTIC CASE WITH EACH BOX

SEND ME YOUR PRICE LIST

SEND ME _____ BOXES AT \$_____ PER BOX
ADD 3% SHIPPING/HANDLING (\$3.00 MINIMUM)
TWO WEEK DELAY FOR PERSONAL CHECKS

PAYMENT ENCLOSED \$_____
(Texas residents add 5% sales tax.)

CHARGE MY: MasterCard Visa

Card No. _____ Exp. Date _____

Signature _____

Name _____ (please print full name)

Address _____ Apt. _____

City _____ State _____ Zip. _____

214-644-2611

Circle No. 92



Software
t' Boot

2116 E. Arapaho #600
Richardson, Tx 75081



Software
t' Boot

2116 E. Arapaho #600
Richardson, Tx 75081

Software
t' Boot

2116 E. Arapaho #600
Richardson, Tx 75081

C64-FORTH for the Commodore 64

FORTH SOFTWARE FOR THE COMMODORE 64

C64-FORTH (TM) for the Commodore 64 - \$99.95

- Fig Forth-79 implementation with extensions
- Full feature screen editor and macro assembler
- Trace feature for easy debugging
- 320x200, 2 color bit mapped graphics
- 16 color sprite and character graphics
- Compatible with VIC peripherals including disks, data set, modem, printer and cartridges
- Extensive 144 page manual with examples and application screens
- "SAVETURNKEY" normally allows application program distribution without licensing or royalties

C64-XTEND (TM) FORTH Extension for **C64-FORTH** - \$59.95
(Requires original **C64-FORTH** copy)

- Fully compatible floating point package including arithmetic, relational, logical and transcendental functions
- Floating point range of 1E+38 to 2E-39
- String extensions including LEFT\$, RIGHT\$, and MID\$
- BCD functions for 10 digit numbers including multiply, divide, and percentage. BCD numbers may be used for DOLLAR.CENTS calculations without the round-off error inherent in BASIC real numbers.
- Special words are provided for inputting and outputting DOLLAR.CENTS values
- Detailed manual with examples and applications screens

(Commodore 64 is a trademark of Commodore)

TO ORDER - Specify disk or cassette version

- Check, money order, bank card, COD's add \$1.50
- Add \$4.00 postage and handling in USA and Canada
- Mass. orders add 5% sales tax
- Foreign orders add 20% shipping and handling
- Dealer inquiries welcome

PERFORMANCE MICRO PRODUCTS



770 Dedham Street. S-2
Canton, MA 02021
(617) 828-1209



Circle No. 93

FORTH-79

Ver. 2 For your APPLE II/II+

The complete professional software system, that meets ALL provisions of the FORTH-79 Standard (adopted Oct. 1980). Compare the many advanced features of FORTH-79 with the FORTH you are now using, or plan to buy!

FEATURES

OURS OTHERS

79-Standard system gives source portability.	YES	_____
Professionally written tutorial & user manual	200 PG.	_____
Screen editor with user-definable controls.	YES	_____
Macro-assembler with local labels.	YES	_____
Virtual memory.	YES	_____
Both 13 & 16-sector format.	YES	_____
Multiple disk drives.	YES	_____
Double-number Standard & String extensions.	YES	_____
Upper/lower case keyboard input.	YES	_____
LO-Res graphics.	YES	_____
80 column display capability	YES	_____
Z-80 CP/M Ver. 2.x & Northstar also available	YES	_____
Affordable!	\$99.95	_____
Low cost enhancement option:		
Hi-Res turtle-graphics.	YES	_____
Floating-point mathematics.	YES	_____
Powerful package with own manual,		
50 functions in all,		
AM9511 compatible.		
FORTH-79 V.2 (requires 48K & 1 disk drive)	\$ 99.95	
ENHANCEMENT PACKAGE FOR V.2		
Floating point & Hi-Res turtle-graphics	\$ 49.95	
COMBINATION PACKAGE	\$139.95	
(CA res. add 6% tax: COD accepted)		

MicroMotion

12077 Wilshire Blvd. #. 506
L.A., CA 90025 (213) 821-4340
Specify APPLE, CP/M or Northstar
Dealer inquiries invited.

Circle No. 94



ATTENTION PROGRAMMERS!!

DATASOFT is currently seeking programs and programmers to add to their rapidly growing and expanding operation. A leading marketer and developer of personal computer software, DATASOFT offers experienced assembly-language programmers the opportunity to join their staff to develop and translate arcade games such as ZAXXON™, as well as to author original material for their games, education and home management product lines. DATASOFT pays competitive salaries, plus bonuses based on product performance. Relocation assistance is available, if needed.

If you have working knowledge of Atari, Apple, TI, or Commodore operating systems, graphics, animation and sound, call or write Melinda Storch at:

Datasoft Inc.
COMPUTER SOFTWARE

9421 Winnetka Ave.
Chatsworth, CA 91311
(213) 701-5161 / (800) 423-5916

Circle No. 95

ZAXXON and SEGA are registered trademarks of Sega Enterprises.
DATASOFT is a registered trademark of Datasoft, Inc.

Skill level required: Both the novice and the expert can benefit from this product.

Reviewer: Chris Williams

Product Name: **Semi-Draw**

Equip. req'd: TRS-80C 32K Extended BASIC

Price: \$21.95

Manufacturer: Computerware

Box 668

Encinitas, CA 92024

Description: *Semi-Draw* is a graphics development and sketching program for the Color Computer. Pictures can be drawn in three resolutions — Semographics 8, 12, or 24. Text can be placed anywhere on the graphics screen. Up to eight colors plus black are allowed, and drawings can be animated by paging through up to six available screens.

Pluses: Allows drawings to be made using the joystick or keyboard. Pictures can be stored or retrieved on tape for use with other software or transferred to a Line Printer VII, Line printer VIII, or NEC 8023 printer. Colors are simulated by dot-pattern densities.

Minuses: The program is not compatible with the RS disk system.

Documentation: A six-page manual is included that describes the operation of the program.

Skill level requires: No special skills required.

Reviewer: John Steiner

Product Name: **Earl's Word Power: Horrible Homonyms**

Equip. req'd: Apple II or Apple II+

Price: \$29.95

Manufacturer: George Earl

1302 South General McMullen
San Antonio, TX 78237

Author: Karen Knudson

Description: This is an educational program that enables the student to practice the most abused homonyms (their/there/they're, its/it's, too/to/two, etc.). Each homonym is defined and used in an example. Then a sentence missing a word is shown, with the homonyms listed below. Paraphrased Shakespearian plays are used for review tests.

Pluses: The program provides instant feedback with the score shown after each problem. When a mistake is made, the program reviews the material and then presents the problem again. The program is completely error-trapped (ignores spurious key entry), and the screen shows large, easy-to-read type. I would recommend this program for school and home.

Minuses: The 13 sets of homonyms are fixed; so a teacher cannot insert her own words. The program does not automatically send low scorers back for another review. Also, there is no provision for saving student scores on disk.

Documentation: One sheet on loading the disk; all necessary instructions are built into the program.

(continued)

COMPUTER ACCESSORIES

ERRORS—DOWNTIME—SERVICE

A speck of dust, dirt, or magnetic oxide on the read/write head of your floppy disk can cause data transfer errors, a disk crash, or even a costly disk drive failure. Regular use of Perfectdata head cleaning diskettes can keep your drive heads clean and your system up and running. The Perfectdata system can be used on single or dual-sided floppy disk drives. (Comes complete with 2 cleaning diskettes, a 4 oz. bottle of CS-85 cleaning solution, and full instructions.)

5.25" Disk Drive Cleaning Kit \$22.75
8" Disk Drive Cleaning Kit \$22.75

ORGANIZE AND PROTECT YOUR DISKETTES

Organize your diskettes with an Innovative Concepts Flip 'N' File from Mercury Micro. Holds up to 50 diskettes in a handsome smoke-colored transparent plastic case.

Case for 5.25" Diskettes \$23.75
Case for 8" Diskettes \$29.75

WHAT'S YOUR FAVORITE NUMBER?

New for spring. Top quality shirts with "64" or "20" printed in large numerals on both front and back. 50/50 blend **will not shrink**. Specify color and size and number choice. Available in red or blue, S-M-L-XL.

\$7.50 each

ORDERING INFORMATION

Phone (301) 994-1122

SHIPPING

Add \$1.50 to all orders for shipping. We pay balance for UPS service on all orders. Add \$2.00 for COD. Maryland residents please add 5% state sales tax.

WRITE OR CALL FOR FREE COMPUTER ACCESSORY CATALOG:
SURGE PROTECTORS, DUST COVERS, BOOKS, DISK MAINTENANCE, BLANK MEDIA AND MUCH MORE.



Mercury Micro Inc.
Dept. F
Cherry Field Road
Drayden, Md. 20630

Circle No. 96

UV EPROM ERASER

- ★ Erases over 15 EPROMS - 15 minutes erase time
- ★ Element life 7700 hours
- ★ Intensity: 12W's $\frac{1}{2}$ cm² at 1"
- ★ Erases all UV EPROMS (2716, 2732, 2516, 2532, etc.)

\$49.95*

* HOBBY MODEL

INDUSTRIAL MODEL

OUV-T8/2N

\$68.95

WITH TIMER AND SAFETY SWITCH

OUV-T8/2T

\$97.50

INTELLIGENT PROGRAMMER STAND ALONE

RS-232

- ★ RELIABLE
- ★ EASY COPY (No external equipment needed)
- ★ USER FRIENDLY

COMPATIBLE:
IBM PC, TRS-80, APPLE, CPM,
FLEX, TEKTRONICS, MDS

(MCS-48)
PROGRAMMING

PRICE INCLUDES
PERSONALITY MODULE

\$489.00

PROGRAMS: 2508, 2516, 2532, 2716, 27C16, 27C32,

2732, 2732A, 2758, 8748, 8749H, 8748H

OPTIONAL MODULES: 2564, 2764, 8755A, 8741

- ★ STAND ALONE, CRT, OR COMPUTER CONTROL
- ★ UPLOAD/ DOWNLOAD IN MOTOROLA OR INTEL HEX FORMAT
- ★ MICROPROCESSOR BASED * 4 K INTERNAL RAM
- ★ 90 DAY PARTS & LABOR WARRANTY ON ALL PRODUCTS

SOON TO BE RELEASED:

PROMPRO-8 128K Version \$689.

MONEY BACK GUARANTEE

LOGICAL DEVICES INC.

781 W. OAKLAND PARK BLVD. • FT. LAUDERDALE, FL 33311

Phone Orders (305) 974-0967 • TWX: 510-955-9496

SEE US AT COMDEX SPRING - BOOTH #3019

Circle No. 97

SUPER SALE

Bulk Diskettes* with envelopes

*Now Get High Quality at a Low Price Manufactured by a Major Disc Company For MDS Without Their Name on Diskettes *Minimum order 20 diskettes with Tyvek envelope and storage shipping box *Quantity Discounts 100 deduct 3%, 1000 deduct 5%, 10,000 deduct 10%, 100% Certified 1 Year Warranty

5 1/4" Soft Sectors

SINGLE SIDE SINGLE DENSITY W/HUB RING	\$1.69*
SINGLE SIDE DOUBLE DENSITY W/HUB RING	\$1.99*
DOUBLE SIDE DOUBLE DENSITY W/HUB RING	\$2.79*

18" Soft or 32 Sectors

SINGLE SIDE SINGLE DENSITY	\$1.79*
SINGLE SIDE DOUBLE DENSITY	\$2.29*
DOUBLE SIDE DOUBLE DENSITY	\$3.09*

PRINTERS

All EPSONS available	Call
GEMINI 10 by Star Micronics	\$359.00
GEMINI 15 by Star Micronics	\$549.00
Okidata Microline 80	Call
Okidata Microline 82	\$469.00
Okidata Microline 83A	Call
Okidata Microline 84	Call

MICROBUFFER

MBP-16K Parallel	\$149.00
MICROBUFFER IN-LINE For Most Printers	
32K Parallel	\$289.00
64K Parallel	\$339.00
32K Serial	\$289.00
64K Serial	\$339.00
64K Memory Expansion Modules	\$169.00

TANDON DISK DRIVE ENCLOSURES

Complete with Chassis & Power Supply: Fully assembled silver or beige chassis with external card edge connector for easy cable installation for 5 1/4" drives. With MDS 120 days warranty \$59.00



BARE DRIVES

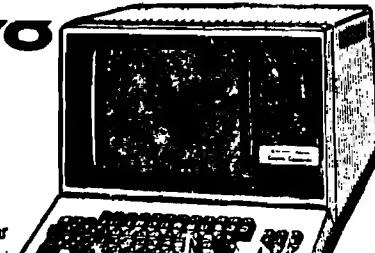
TM100 1 40 Trk	\$199.00
TM100 2 40/40 Trk	\$269.00
TM100 4 80/80 Trk	\$339.00
SIEMANS FDD100 8 SS/DD 8 in	\$279.00
TM50 SS DD 40 Trk Thinline	\$199.00
TM84B 1 SS/DD 8" 77 Trk Thinline	\$369.00
TM84B 2 DD/DD 8" 77 Trk Thinline	\$479.00

Add \$59.00 For Complete 5 1/4" Drive System

SANYO

MCB 1000 High Performance Business System

- Includes FREE MicroPro Software • WordStar • SpellStar
- MailMerge • CalcStar
- And More • Z-80A C.P.U.
- 64KB RAM
- 32KB mini floppy disk drive
- CP/M operating system
- 12" non-glare green phosphor video display screen
 - Centronics parallel printer port
 - RS232C serial port
 - Additional disk drives up to 2.3MB



\$1595

SAVE \$200*

(* If purchased separately)

CASH ORDERS ONLY

MDS

22295 EUCLID AVE.
EUCLID, OHIO 44117

Call (216) 481-1600

WE ACCEPT
• Visa
• MasterCard
• Checks
• Money Order
• C.O.D.

ALL PRICES
ARE FOR
MAIL ORDER ONLY
Prices, Specifications
and Offerings subject
to change without
notice

ADD \$3.00 FOR
SHIPPING
& HANDLING
\$6.00 Extra for
C.O.D. Orders
Ohio Residents
Add 5% Sales Tax

DEALER INQUIRIES WELCOME

Circle No. 98

Upgrade Your

BBR
BBS
BRA
PHX
PHY
PLX
PLY
RMB
SMB
STZ
TRB
TSB

With The 6502 Upgrade Kit

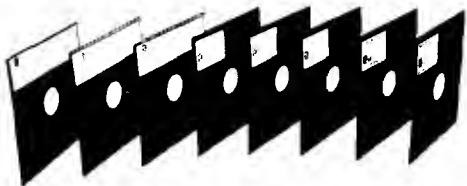
\$3

southwestern data systems™
10761 Woodside Ave., Suite E • P.O. Box 582 • Santee, CA 92071

Circle No. 99

 **Dysan**
CORPORATION

better from inside out



at the lowest price!

Call our Modem Hotline (anytime) - 619-268-4488
for exclusive monthly specials. Our free catalog
contains more than 600 fantastic values.

ABC Data Products

(formerly ABM)

8868 CLAIREMONT MESA BLVD.
SAN DIEGO, CALIFORNIA 92123

ORDERS ONLY ITT TELEX INFORMATION
800-850-1555 4992217 619-268-3537

Skill level required: This program is good for anyone with fourth grade-to adult-level English. No programming required.

Reviewer: Mary Gasiorowski

Product Name: **HEXDOS 4.0**
Equip. req'd: OSI C1P or Superboard with BASIC-in-
ROM and disk drive
Price: \$49.50 includes diskette and manual
Manufacturer: The 6502 Program Exchange
2920 West Moana
Reno, NV 89509
Author: Steven P. Hendrix

Description: *HEXDOS* is a disk-operating system for the OSI C1P system that requires only one disk track and 2K of memory for the DOS. It uses BASIC-in-ROM routines where possible to keep the DOS small.

Pluses: A real DOS is possible with as little as 8K of RAM. The user has 38 disk tracks available for storage and approximately 12K more memory than OS65D. The USR routine has been substantially expanded to do many things in addition to calling user-written routines. The "SAVE" command will create a disk file if none exists. File names may be of any length and are allowed to contain embedded blanks. Assembly-language files are uniquely identified and stored with load and execution addresses. Data files may be written and read from BASIC — up to 22 files may be open simultaneously. Opening the file automatically creates the necessary buffer space. The rubout key is now a non-destructive back space. *HEXDOS* will operate with CEGMON as well as the standard OSI monitor chip. Several hardware enhancements are supported (real time clock, tone generator, etc.). The program appears to be well supported by its author, with updates offered from time to time. Consultation is provided willingly in case of user problems.

Minuses: Lack of compatibility with OS65D. Disks created by *HEXDOS* and OS65D are mutually unreadable. I have an assembly-language routine to read OS65D sectors under *HEXDOS*, and a BASIC program for copying OS65D files to *HEXDOS* disks, that I will publish in the next issue of the *HEXDOS* Newsletter for current users, and include with future purchases of *HEXDOS*. The changes in the USR mentioned above require that any existing program using USR must be revised to run with *HEXDOS*. *HEXDOS* retains most of the features of BASIC-in-ROM, including 7-digit floating-point precision (OS65D now has 9½-digit f.p., - but 7-digit f.p. is faster and uses less memory if the precision is adequate for your work). The notorious garbage collection bug has not been fixed. (In fairness I must point out that a corrected BASIC ROM3 chip is available elsewhere at modest cost.) The smallest unit on disk is a track (i.e., one sector of 2K bytes per track).

Documentation: Newly revised 40-page manual, including demonstration programs and appendices. Terse, but apparently complete and error-free.

Skill level required: Ability to program in BASIC. No assembly-language experience is needed.

Reviewer: Rolf B. Johannessen

MICRO™

HAVE YOU FLOWN YOUR ATARI TODAY?

FINAL FLIGHT!

Imagine yourself at the controls of a small, single-engine plane, 10,000 feet in the air, on your approach to the runway and safety. You're running low on fuel, but your instruments show that you're on the glide path, and lined up with the runway. It's a beautiful, sunny day, and you can see the airport in the distance, across the grassy fields. But the crosswind is tricky, and it will take all your skill to land safely. You're coming down now, and the runway is getting closer. A bit left, OK, now lower the power, fine, now put down the flaps. Pull the nose up a bit more, you're a little low. Watch the power! Don't stall. OK. Here comes the runway. You hear the squeal of tires on

MMG
•

6% sales tax.

MICRO

pavement, your pulse quickens, you're down, but watch it, you're pulling right! Brakes, brakes! Left more!

You've stopped safely! Good job.

The first real-time flight simulator for ATARI is now available from MMG Micro Software. Written entirely in machine language, there are four levels of difficulty, landings in clear or foggy weather, landings with or without instruments, and with or without the real-time view from the cockpit. **Final**

Flight! requires Atari 400/800, 24K, 1 joy stick, and is offered on tape or disk for the same suggested retail price of \$29.95.

MMG



**Final
Flight!**

is available at
your local dealer or direct

from **MMG Micro Software**. Just

send check or money order to P.O. Box

131, Marlboro, N.J. 07746 or for Mastercard,

Visa, and C.O.D. deliveries call **(201)431-3472**. Please

add \$3.00 for postage and handling. New Jersey residents add

Atari is a registered trademark of Atari, Inc.

6809 Bibliography

136. Color Computer News, Issue 14 (November, 1982)

Sias, Bill, "REMARKS," pg. 3.

Remarks on the 6809-based color computer of Tandy *versus* other Tandy micros.

Klement, George E., "HEX/DEC Conversion," pg. 10.

A listing for the TRS-80 Color Computer.

Benenson, Alexander, "Screen Print Program for the Color Computer," pg. 13.

A listing and notes on a utility for the Color Computer.

Perry, Thomas, "CW Send/Receive Program," pg. 14-21.

An amateur radio utility for the Color Computer.

Degler, Roger L., "Flex Corner," pg. 24-27.

A discussion of operating systems for the 6809-based color computer.

Steiner, John, "Morse Code Instruction: Part 2," pg. 30-32.

Programmed CW instruction for the TRS-80 Color Computer.

Hogg, Frank, "64K Korner," pg. 34-36.

Teletypewriter and FLEX and use of an external terminal.

Norris, Danny, "Chromaledger," pg. 38-45.

Chromaledger is an easy-to-use expense account program written for the 32K Extended BASIC Color Computer.

Pakerski, Andrew, "Tumble," pg. 46-48.

A game program for the Color Computer.

McGarry, Donald L., "Slither," pg. 49-52.

A programming game for the 6809-based Color Computer.

Aker, Jack L., "Care and Feeding of RS Disk Drives," pg. 54-56.

Discussion and diagnostic test program for Radio Shack Color Computer disk drives.

Kelty, John R., "A 'Cheap Talker' for the Radio Shack Color Computer," pg. 58-63.

Hardware and software for a speech program for the Color Computer.

Trepal, George, "POKE and String Graphics for the 4K Color Computer," pg. 64-67.

POKE and string graphics are much faster than SET and RESET graphics.

Sullivan, Steve, "Slope and Linear Graphing," pg. 68-70.

A program for graphing various algebraic equations.

Giovanoni, Richard, "Estimating On My Color Computer," pg. 73-77.

A program for proposal estimates.

Anon., "Learning ASCII Codes," pg. 82-83.

A learning program intended to burn the ASCII codes into your subconscious.

Knight, Glen B., "How I Learned to Soundex Code and Love My Color Computer," pg. 89-91.

Family names are often spelled various ways. A Soundex code assists in retrieving these names in a computer file.

137. System-68, No. 2 (August, 1982)

Pass, Edgar M., "A Comparison of FLEX and UNIFLEX," pg. 7-19.

A detailed discussion and comparison of two operating systems for 6800 and 6809 systems.

Hughes, James, "Dynamic Address Translator," pg. 21-26.

An explanation of how the 6809 Dynamic Address Translation and Extended Memory Addressing software (SWTPC) work in order to be able to program them for correct operation.

138. System-68, No. 4 (November, 1982)

Pentecost, Joe, "Beginning Assembly Language Programming," pg. 8-28.

A tutorial to machine-language for the 6800- and 6809-based systems.

139. '68' Micro Journal 4 Issue 12 (December, 1982)

Reitzel, Norman L., "6809 Problems," pg. 10-11.

Discussion of some bugs in the 6809 with low mask numbers, and fixes available.

Anderson, Ronald W., "FLEX User Notes," pg. 11-14.

Discussion of the use of 6800 and 6809 programs.

Nay, Robert L., "Color User Notes," pg. 14-18.

Discussion of needs filled by the TRS-80 Color Computer, as an advanced system, as an excellent educational tool, and as a very good tool for control systems.

Kelty, John R., "Cheap Talker," pg. 18-19.

A speech program for the 6809-based Color Computer.

Hunt, Thomas H., "Hi-Res Color Graphics," pg. 19-22.

Arcade graphics by adding a special TMS-9918A and some other chips to your 6809-based system.

Lyon, Stewart D., "Adapting the Microworks SDS80C to FLEX09 DOS," pg. 12-24.

Detailed instructions for system modification, including an assembly-language listing.

140. The Rainbow 1, No. 6 (December, 1982)

Noian, Sara, "Micro-Maestro," pg. 10-28.

Using the 6809-based Color Computer's PLAY statement.

How to program music on the micro.

Schrag, Roger, "Patch EDTASMplus to Disk to End Those Cassette Blues," pg. 29-32.

How to modify the EDTASMplus package to support disk drives on the Color Computer.

Stumpf, Peter, "You'll Log This Program for Holiday Merriment," pg. 34-36.

Graphics for a fireplace complete with glowing flame and stockings hung with care.

Inman, Don, "High-Resolution Graphics Techniques Are Explained," pg. 41-48.

A tutorial with several demo listings for the 6809-based Color Computer.

Nolan, Bill, "Pressed for Time? Paint a Dungeon!" pg. 50-52.

How to speed up the actual play of a fantasy game by properly using the 6809 graphics ability.

Hands, Lester, "Memory Exam: Where Does it Start?" pg. 54-55.

A machine-language utility routine that allows you to rapidly examine memory and determine the address of items of interest.

Blyn, Steve, "Sustain Children's Interest By Expanding Relevance," pg. 56-60.

Motivating the young computer user to go beyond games and learning programs. A sample listing is included.

Kolar, Joseph, "On Printing Alphanumerics in Eight Directions," pg. 62-64.

A program to allow printing in any of the eight motion directions as used in the Color Computer's DRAW command.

Benenson, Alexander, "Screen Print Program for the Color Computer," pg. 13.

A listing and notes on a utility for the Color Computer.

Konecky, Larry, "This Is Just Like Music to Your Eyes," pg. 66-72.

In this Color Computer program music can be written and presented on a music staff on a black background.

Bennett, J.E. and Laidlaw, "From Out of the Blue Comes This Dexterity Test," pg. 76-80.

A parachute drop game for the Color Computer.

Roslund, Charles J., "Format Your LLISTings with FLIST," pg. 86.

A formatting utility machine-language routine for the 6809-based Color Computer.

Wells, Geoff, "Go Adventuring with GAPAD," pg. 98-104.

A game-writing utility for the TRS-80 Color Computer.

MEGAFLEX[®] ABILITY

You Pick The Disk System, *MegaFlex* Controls It!

WITH SOFTDRIVERS FOR A FLEXIBLE FUTURE!

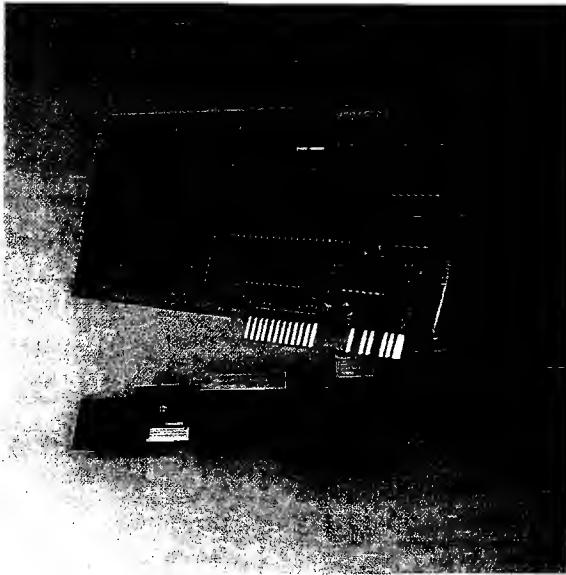
MEGAFLEX—a universal floppy disk controller and modern alternative to the Apple drive system offering increased storage, improved reliability and . . . FLEXIBILITY.

Enjoy megabytes of online storage with your choice of micro, mini, or maxi drives—or even 6Mb with the Amlyn cartridge pack! Ideal for high-capacity storage now, Winchester-disk backup later.

The MEGAFLEX secret is to autoboot soft-drivers that match the needs of your drive system. All hardware functions are software-controlled. MEGAFLEX can match new drive capabilities without hardware changes. Drive-dependent ROMs have been eliminated.

APPLE //? OF COURSE!!

MEGAFLEX is compatible with BASIC, CP/M, Pascal, VISICALC, SOS and DOS-emulation on the Apple III, Apple II, Franklin Ace and Basis. All language features and operating system commands (LOAD, BRUN, etc.) are standard. If you can operate Apple drives you can operate MEGAFLEX! Your Apple software will run without modification too.



BRIDGE THE APPLE FORMAT BARRIER!

The MEGAFLEX diskette does what Apple's cannot—read and write diskettes from other computers! Software-controlled industry-standard IBM 3740 or System 34 type formats allow the MEGAFLEX library of reformatting software to read and write Altos, Radio Shack, Osborne, and IBM PC diskettes. (Call for the latest software details.)

MORE STORAGE, MORE UNIVERSAL FEATURES, LOWEST COST

MEGAFLEX with 8" maxi or high density 5.25" minis gives you 1.2 Megabyte of formatted data per diskette for 8 times the file and data size!

MEGAFLEX offers flexible software choices:

- data rate (250/500 Kbits per second),
- single and double density recording, and
- single/double sided drive operation (max 4 drives).

MEGAFLEX has the lowest chip count of any controller today! This means less power, a cooler Apple and better reliability.

Lowest price, highest performance, that's

MEGAFLEX!

11722 SORRENTO VALLEY ROAD
SAN DIEGO, CA
(619) 452-0101
TWX 910-335-2047 APPLE TWO SDG

MEGABYTER[™]

A Division of SVA

TRADEMARKS CP/M—Digital Research

Circle No. 102

ACCESS UNLIMITED

MICRO SHOPPING CENTER

NEW PC-POWER PACK™ FOR IBM-PC™

Two microcomputer industry leaders, Digital Research Inc. and Percom Data Corp. has agreed to produce "PC-POWER PACK™", a complete package consisting of a Percom Data Winchester 5 1/4" Hard Disk Drive, a 256K RAM board and controller, and Digital Research's Concurrent CP/M-86™, the single-user, multitasking operating system. The PHD™ System provides plug-in compatibility to the "IBM-PC", and speed and accuracy many times that of floppy systems. Storage capacity of the Percom Data Hard Disk ranges from 5 to 30 megabytes. **CALL FOR PRICE.**

Access Unlimited Hard Disk Drives For TRS-80*, "IBM-PC", "APPLE II"

- 5, 10, 15 Megabyte and larger drive units.
- Lets controller handle up to 4 drives.
- Works along with existing floppy disk drives.
- Includes host system support software.

From
\$1395.00
(5MB)
For TRS-80

Your present system too small?

Take advantage of the iBEX company business system and stand alone word processing systems — overbuild mistake — **model No. 7202 Regular retail \$9070.00 with software**

Now for a limited time only **\$2595.00** — while supply lasts

Look what you get for \$2595

- Z80 • CP/M compatible
- 64 kilobyte RAM 4KB RAM
- Dual 8" floppies (total 2.4 Million Characters)
- Switchable to IBM 3740 format
- 12" green phosphor monitor (80 x 24, 40 x 24, 32 x 14 characters)
- Centronics compatible printer interface
- Serial interface
- Full function keyboard
- Clock timer and calendar w/battery
- **Over \$2200 in Free software:** CP/M Operating System, M/Basic Interpreter, Perfect Writer, Perfect Speller, Perfect Calc, Perfect Filer

F.O.B. Dallas, TX

SPECIALS OF THE MONTH:

• NEW "Star Gemini" Printer

Dot Matrix Model 10 — Reg. \$499.00 Sale **\$369.90**
100 CPS Model 15 — Reg. Retail \$699.00 Sale **\$525.00**

• NEW "C-ITOH F-10 Starwriter" Printer

Reg. Retail \$2295.00 Sale **\$1595.00**

CLOSEOUT: "Brother" HR1 Daisywheel Printer

Serial — Closeout Sale **\$799.00** Parallel — Closeout Sale **\$745.00**

"Perfect" Software For "IBM-PC" or 8" CP/M

"Perfect Writer" Reg. Retail \$495.00 Sale **\$299.90**
"Perfect Filer" Reg. Retail \$595.00 Sale **\$309.90**
"Perfect Calc" Reg. Retail \$295.00 Sale **\$159.90**
"Perfect Speller" Reg. Retail \$295.00 Sale **\$159.90**

All Four Fully Integrated Reg. Retail \$1680.00 Sale **\$849.90**

New! Dual Headed Drives for the Price of Flippies!

Now you can have a "dual headed" "PERCOM" Drive System for your TRS 80 Model III!!

TFD344N1 One Drive dual headed double-density **\$560.00**
TFD344N2 Two disk dual headed double-density **\$860.00**

*completely compatible with programs existing on single sided or double sided diskettes.

"Percom Data" Drives For "Atari"

Access single density drives. 102k storage but much cooler, quieter and more efficient than the 810! Our flexible drives let you cable your first-drive system directly into your computer. Or go through an 810 drive. And our Access controllers automatically handle single-and double-density drives in the same system.

AT88-S1	First drive single density	\$478.00
AT88-A1	Add on drive single density	\$339.00
RFD40-S1	First drive double density	\$599.00
RFD40-A1	Add on drive double density	\$349.00
RFD44-S1	First drive double sided	\$729.00
ATARISEP	Data separator for 810 drive	\$ 24.95

BUY DUAL UNITS — FOR EVEN BIGGER SAVINGS!

Bare Drives for "IBM-PC" — Internal

Single Head 160K — **\$279.95**
Dual Head 320K — **\$354.95**

"Percom" Drives For "IBM-PC" External

Single Head 160K — **\$415.95** Includes Case
Dual Head 320K — **\$510.95** & Power Supply

MODEMS

"U.S. Robotics" Auto Dial 212A Reg. \$599.00 —	Now \$549.00
300/1200 baud, totally "Hayes" compatible	
"U.S. Robotics" Auto Link 300 Reg. \$219.00 —	Now \$169.00
"Signalman" Auto Answer 0-300 baud	From \$99.00

MEDIA FOR LESS — Save \$\$

BASF 5 1/4" Lifetime Limited Warranty

Single sided Double density	Reg. \$44.95 \$24.90 bx of 10
Double sided Double density	\$31.90 bx of 10

SENTINEL complete with hub rings & lifetime warranty

Single sides Single density	\$18.80 bx of 10
Single sided Double density	\$20.70 bx of 10
Double sided Double density	\$27.80 bx of 10

MAXELL

Single sided Single density 5 1/4"	\$36.95 bx of 10
Double sided Double density 5 1/4"	\$49.95 bx of 10

MEMOREX

Single sided Single density 5 1/4"	\$32.95 bx of 10
Double sided Double density 5 1/4"	\$48.95 bx of 10

Buy Diskettes In Bulk & SAVE !! . . .

Single sided Single density Only **\$179.95**/case of 100

Envelopes Available At **\$1.15** Each

** Reg. Trademarks • Limited Time Offer/Limited Quantities • Prices subject to change without notice • Prices do not include state taxes



1 (800) 527-3475



Order by phone or by mail. We accept Visa, MasterCard, cashier's checks, certified checks, and money orders. With personal checks, allow additional time for bank clearance. Your bankcard will not be charged until your order is shipped. On orders over \$1,000, we pay freight (surface only) and insurance; please add \$3.00 shipping and handling under 50 lbs. Over 50 lbs., add \$5.00 for orders under \$1,000.00. Texas residents add 5% sales tax. Allow 2 to 4 weeks for delivery

YES, I'm taking advantage of your Sales Prices.
 Please send me a FREE catalog. I'm not ready to order at this time.

Name _____

Company Name _____

Address _____

City _____ State _____ Zip _____

Phone Number () _____

Quantity	Item	Unit Price	Subtotal
----------	------	------------	----------

Check one: State Sales Tax (Texas residents only)

payment enclosed handling charge

Visa MasterCard* Total

--	--	--	--	--

*If Master Card, numbers above name:

--	--	--	--

 Expiration Date:

--	--	--

 -

--	--

Authorized signature, if charged

ACCESS UNLIMITED

DEPT. N-7/401 N. Central Expwy./Richardson, Texas 75080

Tel. 1-800/527-3475 214/340-5366

214/690-0207 — Sat. and Evenings Only



FOR YOUR APPLE II

Industry standard products at super saver discount prices

SOFTWARE

ARTSCI	List	SGC
Magicalc	\$149.00	\$ 99.00
Magic Window II	149.00	99.00
DBase (Apple)	695.00	475.00

BRODERBUND

Payroll	\$395.00	\$295.00
Choplifter	34.95	25.00
Arcade Machine	44.95	29.95
Serpentine	34.95	25.00
Home Accountant	74.95	55.00
Home Accountant Plus	150.00	109.00

DATAMOST

Snackattack	\$ 29.95	\$ 22.50
Thief	29.95	22.50
Swashbuckler	34.95	24.95
Zork I, II, or III	39.95	27.95
Starcross	39.95	27.95
Format II	250.00	175.00
System Saver & Fan	59.95	49.00
Multiplan	275.00	199.00

ON LINE

Mystery House	\$ 24.95	\$ 19.95
Cranston Manor	34.95	24.95
Frogger	34.95	24.95
Screen Writer II	129.95	99.95
Memory Management II	49.95	39.95

PEACHTREE

GL, AR, AP, Inventory, Payroll	ea. \$400.00	ea. \$295.00
Micro Buffer II	299.00	249.00

SENSIBLE SOFTWARE

Super Disk Copy III	\$ 29.95	\$ 22.95
DOS Plus	24.95	17.95

SERIUS SOFTWARE

Bandits	\$ 34.95	\$ 26.95
Epoch	34.95	26.95
Fly Wars	29.95	22.95
Gorgon	39.95	29.95
Sneakers	29.95	22.95
Joy Port	74.95	59.95
Wizardry	49.95	34.95
Night of Diamonds	34.95	26.95
Star Maze	34.95	26.95

PFS	125.00	89.95
PFS Report	95.00	69.95
PFS Graph	125.00	89.95
Data Capture 4.0	64.95	49.95
Merlin/Assembly Lines	119.95	89.95
Merlin	64.95	49.95
ASCII Express Pro	129.95	99.95
Transend II	149.00	119.00
Transend I	89.00	65.00
DB Master	229.00	165.00
DB Utility Pack	99.00	79.00

STRATEGIC SIMULATION

All Software	\$ 59.95	\$ 39.95
All Software	39.95	27.95

SYNERGISTIC SOFTWARE

Wilderness & Dungeon	\$ 32.50	\$ 24.95
GPLE	64.95	49.95
TG Joystick	59.95	45.00
Select-A-Port	59.95	45.00
Wordstar	325.00	175.00
Spellstar	175.00	175.00
SuperCalc	175.00	175.00
VisiCalc	179.00	179.00

SPECIAL AND NEW

FRANKLIN ACE 1000 COMPUTER

Hardware and Software compatible with Apple II **\$950**

FRANKLIN ACE 1000 COMPUTER plus DISK DRIVE, CONTROLLER, and MAGICALC **\$1,250**

EXPAND-A-RAM™ PLUS MAGICALC™

Everything that Visicalc™ can do and much more — plus additional memory. Fully compatible with Visicalc. Includes DOS, CP/M, Pascal Disk Emulator. No preboot or Apple modification required.

64K EXPAND-A-RAM plus MAGICALC **\$375**

128K EXPAND-A-RAM plus MAGICALC **\$449**

APPLEsureance II™

Diagnostic Disk Controller and System Assurance Package. Standard disk controller plus automatic check of system hardware **\$99**

5 1/4" DISK DRIVE

Use with either standard Apple II disk drive or APPLESureance II **\$249**

GRAPHITI CARD

Prints HIRES page 1 or 2 from onboard firmware. Features: True 1:1 aspect ratio, prints emphasized mode, reverse mode, rotates 90 degrees... plus more. Compare all this with the Grappler. We think you'll agree that this is the best graphics card on the market. Specify for use with EPSON, NEC-8023, C-ITOH Prowriter, or Okidata.

(List: \$125) **\$89**

PARALLEL PRINTERS

NEC 8023 or C-ITOH 8510

(Virtually identical) Specifications: • 100 CPS dot matrix printer • 80 column print • 136 characters per line • Tractor/friction feed • 7 different print fonts included • 2K printer buffer • Proportional spacing • Bit image graphics and graphic symbols.

NEC 8023 or C-ITOH **\$475**

NEC 8023 or C-ITOH 8510 with

Parallel Interface and Cable **\$550**

EPSON 100 with Parallel Interface and Cable **\$775**

BROTHER Daisywheel Printer **\$895**

VERSACard FROM PROMETHEUS

Four cards on one! With true simultaneous operation. Includes: (1) Serial Input/Output Interface, (2) Parallel Output Interface, (3) Precision Clock/Calendar, and (4) BSR Control. All on one card. Fully compatible with CP/M* and Apple Pascal*.

(List: \$249) **\$169**

WORD PROCESSING SPECIAL WITH WORDSTAR AND SUPERCALC!

Do professional word processing on your APPLE. All necessary hardware and software included. Complete 80 column video display, enhanced character set, 16K memory board, Z-Card with CP/M* software, Wordstar and word processing software and SuperCALC.

(List: \$1,228) **Special at \$795**

Z-80 CARDS

	List	SGC
Microsoft Softcard Z-80	\$399.00	\$289.00
ALS Synergizer	749.00	595.00
U-Z-80 Processor Board		125.00
Microsoft+ Premium Syst.		595.00

80-COLUMN CARDS

	List	SGC
Smarterm 80-Col Display	\$345.00	\$225.00
Smarterm Expanded Character Set		40.00
Combination Smarterm & Exp. Char. Set		260.00
Videx Videoterm		275.00
Videx Enhancer II	149.00	125.00
Videx VisiCalc Preboot	49.95	45.00

MODEMS FOR YOUR APPLE II

Hayes Smartmodem 300	\$229.00
Hayes Smartmodem 1200	550.00
Micromodem II	279.00
Hayes 100 Baud	Call
Apple Cat II	389.00
D Cat Modem	199.00

MONITORS

Amdek 300G Green	\$159.00
Color - Taxan RGB with Interface	395.00

PARALLEL INTERFACE

Centronics Compat. PRT-1 **\$ 69.00**

JOYSTICK

Replaces two Apple Paddle Controllers **\$ 59.00** **\$ 39.00**

FUNCTION STRIP

.... **\$ 79.00** **\$ 65.00**

MEMORY EXPANSION

Prometheus 16K RAM Module complete **\$169.00** **\$ 65.00**

5 1/4" FLOPPY DISKS

Box of 10 with hub rings **\$ 19.95**

With other purchase **23.00**

Without other purchase **23.00**

All equipment shipped factory fresh. Manufacturers' warranties included. California customers add 6 1/2% tax. Include payment by personal check, money order, or cashier's check with order and SGC will pay shipping charge. Call for amount of shipping charge when paying by credit card.

All items are normally in stock

415) 490-3420

... And we'll be here to help after you receive your order. Feel free to call the SGC Technical Staff for assistance.

SGC
The mail order specialists

342 Quartz Circle, Livermore, CA 94550

Circle No. 104

127

Advertiser's Index

AB Computers	30
ABC Data Products	122
Access Unlimited	126
Acorn Software Systems	14
Alternative Energy Products	103
Amdek	6
Amplify	86
Anthro-Digital Software	44
Apple Tree Electronics	111
Arbutus Total Soft	91
Ark Computers	22
Armadillo Software	2
Artisan Software	87
Aurora Software	11
Avant-Garde	68
Boulder Logical Testing Inc.	108
Check-Mate	93
Commander Magazine	103
CompuSense	11, 12, 13, 31, 45, 112
CompuTech	111
Compu-Way	75
Computer Case Co.	7
Computer Entrepenuer	77
Computer Mail Order	108, 109
Computer Marketing	39
Computer Science Engineering	100
Custom Computer Systems	66
Datamost, Inc.	59, 110
DataSoft, Inc.	120
Design Dynamics	80, 113
D & N Micro	105
Don't Ask Software	25
Eastern House Software	41
Excerpt	91
Execom, Inc.	15
Foxfire Systems	13
Granite Computer Sales	92
Hollywood Software	40
Howard Sams	107
I J G	49
In Home Software	1
Intec Peripherals	116
Interesting Software	79
Ironside Computer	96
J & M Software	49
John Bell Engineering	97
Leading Edge	Cover IV
Logical Devices	121
Manx Software	112
Mercury Micro Inc.	121
Micro Data Supplies	121
Micro House	3
Micro Motion	120
Micro Spec	86
Microware Distributing	79, 117
Midnight Software	118
Midwest Micro	37
Mind Systems Corporation	57
MMG	123
Modular Mining Systems	63
Modular Systems	117
Monarch Data Systems	49
Moore Business Centers	113
Ohio Computer Camp	118
Omega Sales	21
Performance Micro Products	119
Perry Peripherals	75
P M I Associates	106
Proteco Enterprises	50
Pterodactyl Software	14
RH Electronics	62, 67
Richvale	61
Rock Roy	Cover II
Sage Computer Technology	9
Scientific Software	15
S G C	127
S J B Distributors	17
Skyles Electric Works	19
Software T' Boot	119
Sorrento Valley Assoc.	125
Southwestern Data Systems	122
Speciality Electronics	57
Spectrum Projects	117
Stellation II	103
Strom Systems Inc.	81
Talbot Microsystems	116
Taylormade Software	92
Thunderhawk	86
Toumayan & Assoc.	44
Unique Data Systems	102
Victory Software	85
Vista Computing	Cover III
Winders & Geist Inc.	104
Zytrex	12
MICRO Advertising	
What's Where in the Apple	48

MICRO INK is not responsible for claims made by its advertisers. Any complaint should be submitted directly to the advertiser. Please also send written notification to MICRO.

National Advertising Representatives

Middle Atlantic and Southeastern States:

Dick Busch Inc.
Richard V. Busch
 6 Douglass Dr., R.D. #4,
 Princeton, NJ 08540 (201) 329-2424

Dick Busch, Inc.
Eleanor M. Angone
 74 Brookline,
 E. Atlantic Beach, NY 11561 (516) 432-1955

serving: New York, Pennsylvania, New Jersey, Delaware, Maryland, West Virginia, Virginia, D.C., North Carolina, South Carolina, Louisiana, Tennessee, Mississippi, Alabama, Georgia, and Florida

West Coast:

The R.W. Walker Co., Inc.
Gordon Carnie
 2716 Ocean Park Boulevard, Suite 1010,
 Santa Monica, California 90405 (213) 450-9001

serving: Washington, Oregon, Idaho, Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, California, Alaska, and Hawaii (also British Columbia and Alberta, Canada)

Mid-West Territory:

Thomas Knorr & Associates
Thomas H. Knorr, Jr.
 33 N. Michigan Avenue, Suite 403
 Chicago, Illinois 60601 (312) 726-2633

serving: Ohio, Oklahoma, Arkansas, Texas, North Dakota, South Dakota, Nebraska, Kansas, Missouri, Indiana, Illinois, Iowa, Michigan, Wisconsin, and Minnesota.

VistaDisk

GREAT INNOVATION

15th century renaissance man, Leonardo Da Vinci, contributed an inexhaustible collection of inventions and ideas to solve the world's problems. These ideas were centuries ahead of their time. The studies on this page deal with experiments in manned flight.

Like Leonardo, Vista Computer is answering many of today's complex computer storage problems. The Vista V1200 is a great solution to Apple II™ storage. Mass storage for your Apple II™ Computer has always been a problem. On one hand, there were the exotic, expensive hard disks with no cost efficient means of backup. On the other hand, the Apple floppy drive lacked the speed and storage demanded by today's professionals.

Vista's V1200 offers both at an incredibly attractive price. The removable VistaPak cartridges offer 6 Megabytes of removable storage each and can be backed up like a floppy.

Now hard disk storage and speed can be yours with the added capability of interchangeable media. The V1200 eliminates

the worries of head crashes, drive alignments, lost data and backup with a new application of field-proven floppy technology.

The VistaPak cartridges hold 6MB of formatted data each. The removable cartridge allows you to keep duplicates of your valuable data as well as to keep separate parts of your accounting, word processing, spread sheet and other applications. No other storage device offers more in flexibility and capability.

- Microprocessor controlled "Intelligent" DMA controller
- Removable data Cartridges • CP/M, DOS & Pascal compatible • "QuickChange"™ DOS enhancement • Interchangeable 1 VistaPak cartridge • Vista 120 Day Warranty

Contact Your Local Vista Dealer or Call 1-800-448-1000



Vista V1200

Apple II is a registered trademark of Apple Computer Corp.